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mr Vladimir Dinić

Student doktorskih studija
vladimirdinic88@gmail.com

BITKOJN KAO DECENTRALIZOVANA VALUTA

Rezime

Bitkojn je prva decentralizovana „peer-to-peer“ kriptovaluta nastala 2009. godine. Osnovna specifičnost ove valute jeste činjenica da njen emitent ne postoji. Sa druge strane, ponuda ove valute je softverski programirana i ograničena. Između ostalog, njene osnovne karakteristike su i relativno sigurna plaćanja, niski transakcioni troškovi, anonimnost korisnika, praktično nemoguće falsifikovanje, nereverzibilnost transakcija, ali i izuzetno nestabilan devizni kurs. I pored brojnih prednosti, korišćenje ove valute je predmet brojnih diskusija, budući da ova valuta nudi mogućnost različitih zloupotreba i obavljanja kriminalnih aktivnosti. Budućnost ove i sličnih valuta u tom smislu zavisi kako od sigurnosti korišćenja tih valuta, tako i od zakonske regulacije ovakvih plaćanja.

Ključne reči: bitkojn, decentralizovana valuta, kriptovaluta, kontrolisana ponuda, elektronski novac

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BITCOIN AS A DECENTRALIZED CURRENCY

Vladimir Dinić, MSc

PhD student
vladimirdinic88@gmail.com

Summary

Bitcoin is the first decentralized peer-to-peer crypto-currency founded in 2009. Its main specificity is the fact that there is no issuer of this currency. On the other hand, the supply of this currency is software-programmed and limited. Among other things, its main features are relatively secure payments, low transaction costs, anonymity, inability of counterfeiting, irreversibility of transactions, but also extremely unstable exchange rate. Despite many advantages, the use of this currency is subject of numerous discussions, as this currency offers the possibility of performing various abuses and criminal activities. The future of this and other currencies in this regard depends on both security and privacy of these currencies, and legal regulation of such payments.

Keywords: bitcoin, decentralized currency, cryptocurrency, controlled supply, e-money

JEL: E41, F31, G11, L86

Uvod

Razvoj informacione tehnologije, kao jedne od najpropulzivnijih privrednih grana današnjice, doveo je do pojave novih oblika alternativnih valuta. Njihove osnovne karakteristike su decentralizovanost, odnosno nepostojanje centralne banke, države, opštine, kompanije ili bilo koje druge centralne institucije koja bi vršila emisiju te valute, kao i stoprocentno oslanjanje na informacionu tehnologiju u procesu njihove emisije i realizacije transakcija.

Predmet istraživanja ovog rada biće bitkojn, decentralizovana valuta nastala pre 4 godine koja među ostalim alternativnim valutama trenutno zauzima najznačajnije mesto i privlači najviše pažnje. Putem analize dostupne akademske literature, statističkih podataka i ostalih relevantnih izvora pokušaćemo da izdvojimo osnovne karakteristike bitkojn valute, prednosti, nedostatke, efekte i perspektive njegovog korišćenja kao oblika decentralizovane kriptovalute. Budući da je broj radova u kojima su opisane karakteristike i efekti korišćenja bitkojn valute relativno mali, cilj ovog rada će biti da na sveobuhvatan način prezentuje osnovne specifičnosti bitkojn valute i kontroverze povezane s njenim korišćenjem.

Struktura rada je sledeća. Prvo će biti opisane osnovne karakteristike bitkojn valute i način na koji se realizuju transakcije u ovoj valuti. Zatim će biti opisan sam proces, tok i efekti njene emisije, kao i formiranje i kretanje deviznog kursa bitkojna, a zatim će biti izdvojene osnovne prednosti i nedostaci bitkojn valute. U nastavku rada će biti opisana uloga finansijskih institucija koje posluju sa bitkojnima, kao i problemi funkcionisanja bitkojna, gde pre svega imamo u vidu različite zloupotrebe i ostale izvore nestabilnosti. Na samom kraju rada će biti prezentovani regulatorni aspekti korišćenje ove valute.

Karakteristike bitkojn valute

Bitkojn (engl. "Bitcoin" - BTC) predstavlja oblik elektronskog novca koji omogućuje plaćanja putem Interneta direktno između transaktora bez učešća finansijskih institucija. Ova valuta je nastala 2009. godine. Ono po

čemu je bitkojn valuta specifična jeste činjenica da je u pitanju decentralizovana valuta, tj. ona funkcioniše bez centralne banke ili druge kompanije koja bi predstavljala emitenta. Takođe, praktično i ne postoje čak ni klasične banke i druge finansijske institucije kao finansijski posrednici. Stoga, da bi se osigurala sigurnost plaćanja i onemogućile različite zloupotrebe, koristi se sama mreža kao sistem koji će kontrolisati regularnost transakcija.

Kao osnovne karakteristike ove virtuelne valute možemo izdvojiti sledeće:

- U pitanju je P2P valuta (engl. „peer-to-peer“). Drugim rečima, za razliku od svih ostalih virtuelnih valuta, BTC je zasnovan na P2P mrežama. Inače, „Peer-to-peer“ predstavlja mrežu računara koji nisu zasnovani na „klijent-server“ tehnologiji, već su svi računari ravnopravni članovi mreže. Obično se koristi za deljenje informacija na taj način što kada jedan računar „podeli“ neki sadržaj, svi ostali računari u mreži će imati pristup tom fajlu.
- Takođe, to je prva „kriptovana valuta“ ili „kriptovaluta“ (engl. „crypto-currency“), tj. zasnovana je na primeni kriptografije sa ciljem kontrole emisije i prometa konkretnog elektronskog novca (Bitcoin.org/en/about n.d.). Drugim rečima, poverenje u ovu valutu se bazira na sigurnosti koju obezbeđuje kriptografija kao nauka koja se bavi metodama zaštita informacija putem šifrovanja i korišćenjem digitalnog potpisa (Sh.wikipedia.org/wiki/Kriptografija n.d.).
- Emitent ove valute nije ni centralna banka ni neka kompanija, već sami korisnici, tj. vlasnici „mining“ računara (engl. „mining“ - „rudarenje“). To praktično znači da na emisiju i promet ove valute ne utiče nijedna centralna banka, odnosno centralni entitet od čije monetarne politike ili bilo čega vezanog za njega može zavisiti vrednost valute. Poverenje u bitkojn zavisi od „poštenog“ funkcionisanja većine tzv. „mining“ računara u mreži (Barber i saradnici 2012, p.400), a koji su inače zaduženi za verifikaciju transakcija. Logički zaključak koji proističe iz ove činjenice ukazuje na to da se sa rastom obima transakcija u BTC valuti može očekivati veća sigurnost, jer što je veći obim transakcija u bitkojn valuti,

Introduction

Development of information technologies, one of the today's most propulsive branches of economy, has led to the occurrence of new forms of alternate currencies. Their basic characteristics are decentralization, i.e. the absence of a central bank, state, municipality, company or any other central institution that would issue the concerned currency, along with the 100% reliance on information technologies in the process of their issuance and realization of transactions.

The subject of this paper will be bitcoin, the decentralized currency originated 4 years ago, which, among other alternate currencies, at the moment occupies the most significant place and attracts the biggest attention. By analysing the available academic literature, statistical data and other relevant sources, we will hereby try to single out the basic characteristics of bitcoin, advantages, disadvantages, effects and prospects of its usage as a form of decentralized cryptocurrency. Given that the number of papers describing the characteristics and effects of using bitcoins is relatively small, the objective of this paper will be to comprehensively present the main specificities of the bitcoin currency and controversies related to its usage.

The paper has the following structure. First, it describes the basic characteristics of bitcoins, and the manner in which transactions in this currency are conducted. This is followed by the description of the very process, flow and effects of bitcoin issuance, and the formation and fluctuations of the bitcoin foreign exchange rate, with a focus on the major advantages and disadvantages of bitcoin. The rest of the paper elaborates on the role of financial institutions using bitcoins, and the problems in bitcoins' functioning, first and foremost referring to various abuses and other sources of instability. To end with, the paper presents the regulatory aspects of using this currency.

Characteristics of Bitcoin

Bitcoin (BTC) is a form of electronic money enabling online payments to be conducted directly among the transaction participants without any participation of financial

institutions. This currency was created in 2009. What makes bitcoins specific is the fact that this is a decentralized currency, functioning without a central bank or any other company representing the issuer. Moreover, there are practically not even any classical banks or other financial institutions as financial intermediaries. Therefore, to ensure payment security and prevent various abuses, the network itself is used as a system controlling the regularity of transactions.

The basic characteristics of this virtual currency are the following:

- BTC is a peer-to-peer (P2P) currency. In other words, as opposed to all other virtual currencies, BTC is based on P2P networks. Namely, peer-to-peer is a network of computers which are not based on client-server technology, all computers being the equal network members instead. It is typically used to share information in the way that, once a computer "shares" a certain content, all other computers in the network will have access to the concerned file.
- Also, BTC is the first crypted currency or "cryptocurrency", based on the implementation of cryptography aimed at the controlled issuance and turnover of the concerned e-money (Bitcoin.org/en/about, n.d.). In other words, the confidence in this currency is based on the security ensured by cryptography, as a science dealing with the information protection methods, such as encoding and digital signatures (Sh. wikipedia.org/wiki/Kriptografija, n.d.).
- The issuers of this currency are neither a central bank nor a company, but the users themselves, i.e. the owners of the mining computer. This practically means that the issuance and turnover of this currency are not under the impact of any central banks, i.e. central entities on whose monetary policy or anything related to it can the currency value depend. The trust in bitcoins depends on the fair functioning of most mining computers in the network (Barber et al, 2012, p. 400), which are in charge of transactions verification. The logical conclusion arising from this fact indicates that the increased volume of BTC transactions implies higher security, because the higher the volume of

praktično će biti teže vršiti zloupotrebe.

- -U pitanju je "open-source" valuta, budući da je kod koji upravlja emisijom i transakcijama otvorenog karaktera, i svi zainteresovani mogu imati pristup.
- U bitkojn sistemu plaćanja praktično ne postoje računi nalik onima koji postoje u bankama. BTC valuta bi mogla biti shvaćena kao sef u kome se nalazi određena vrednost. Ono što formalni vlasnici određene količine BTC valute praktično poseduju jeste ključ koji im omogućuje jedinstven i ovlašćen pristup tom sefu, odnosno plaćanje.

Navedene osnovne karakteristike bitkojna mogu se ilustrovati kroz sledeću rečenicu: „Temelj bitkojn filozofije je u kombinaciji kriptografske sigurnosti digitalnog sveta koju čini veliki broj računara povezanih u jaku i neuništivu peer to peer mrežu i ograničenoj količini raspoloživih resursa kao što je to slučaj sa srebrom i zlatom (maksimalan broj bitkojn novčića je 21 milion, trenutno u opticaju je oko 11,5 miliona (prim. aut.)) čineći tako jaku i stabilnu takozvanu kriptovaluu koja se nalazi na Internet mreži ali fizički nije prisutna ni u jednoj zemlji na svetu“ (Bitcoinbalkan.com 2012).

Šema transakcije u bitkojn valuti

Bitkojn valuta može biti kreirana na Internetu od strane bilo koga, tj. od bilo kog člana mreže čiji računar vrši verifikaciju transakcija. Pritom, svaki računar u mreži može predstavljati tzv. "node", tj. „mining“ računar koji zajedno sa ostalim računarima učestvuje u verifikaciji iniciranih transakcija. Sam proces verifikacije transakcija predstavlja dodavanje digitalnog zapisa u tzv. "glavnu knjigu" izvršenih bitkojn transakcija, odnosno u "lančani zapis blokova transakcija" (En.bitcoin.it n.d.). Pod blokom transakcija se podrazumeva skup nedavno generisanih transakcija koje čekaju verifikaciju od strane ostalih računara u mreži. Inače, sam bitkojn se može smatrati lancem digitalnih potpisa. Naime, svaka transakcija se verifikuje od strane određenog broja ostalih

računara u mreži, pri čemu se sve te transakcije u digitalnom zapisu čuvaju u samom elektronskom formatu koji reprezentuje bitkojn valutu.

Ovaj proces verifikacije transakcija se u tom smislu obavlja od strane većeg broja računara u mreži, kako bi se obezbedila veća sigurnost i regularnost verifikovanih transakcija. Dodatnu sigurnost pruža "vremenski pečat" (engl. "timestamp") kao integralni deo svakog lanca digitalnih potpisa (Nakamoto n.d., p.2), čime se obezbeđuje autentičnost transakcija, odnosno sprečava mogućnost višestrukog korišćenja jedne iste količine bitkojna za kupovinu različitih dobara i usluga. Takođe, svaki blok sa sobom nosi i određeni matematički problem koji računar mora da reši. Svaki od tih zadataka je moguće rešiti na više načina, a dovoljno je pronaći jedan kako bi transakcija bila realizovana. Za svaki uspešno rešeni zadatak generiše se određen broj bitkojna kao nagrada za vlasnike računara koji su „rešili zadatak“. Ovo je istovremeno i način na koji bitkojn privlači nove korisnike. Nakon prijema bitkojna po osnovu određene transakcije, potrebno je da protekne određeni vremenski period od 10 minuta do 1h, da bi primalac mogao da koristi taj novac. Kao razlog ovog čekanja navodi se činjenica da je potreban određeni vremenski period za pronalaženje bloka transakcija koji će se verifikovati (En.bitcoin.it n.d.). Inače, bitkojn novac nastaje u računarskom programu koji se zove "Bitkojn rudar" (engl. "Bitcoin miner").

Prethodno opisani proces realizacije transakcija u bitkojn valuti bi se šematski mogao predstaviti na sledeći način:

Šema 1: Šema transakcija u bitkojn valuti

- BTC transactions, the more difficult it will practically be to carry out abuses.
- BTC is an open-source currency, given that the code managing issuance and transactions is of open nature, with all interested parties being able to gain access.
 - In the bitcoin system of payments there are practically no accounts like the ones existing in banks. BTC could be understood as a safe storing certain value. What the formal owners of a certain amount of BTC actually own is the key enabling them a unique and authorized access to that safe, i.e. payment.

The above-listed basic characteristics of bitcoin can be illustrated by means of the following sentence: “The foundation of bitcoin philosophy lies in the combination of cryptographic security of the digital world consisting of a large number of computers connected into a strong and indestructible peer-to-peer network, and the limited amount of available resources like silver and gold (the maximum number of bitcoins is 21 million, with about 11.5 million currently in circulation), thereby making the so-called cryptocurrency, strong and stable, to be found on the Internet network, without being physically present in any of the countries worldwide” (Bitcoinbalkan.com, 2012).

Bitcoins Transaction Scheme

Bitcoins can be generated on the Internet by anyone, i.e. by any network member whose computer verifies the transactions. In this process, every computer in the network may represent the so-called node, i.e. the mining computer, which together with other computers participates in the verification of initiated transactions. The transactions verification process itself represents the addition of a digital signature into the “general ledger” of conducted bitcoin transactions, i.e. into the “block chain of transactions” (En.bitcoin.it, n.d.). The block chain of transactions implies a series of recently generated transactions waiting to be verified by other computers in

the network. Bitcoin itself can be considered a chain of digital signatures. Namely, each transaction gets verified by a certain number of other computers in the network, with all these transactions in the digital entry being kept in electronic format representing bitcoins.

The transactions verification process is thereby conducted by a large number of network computers, in order to ensure higher security and regularity of verified transactions. Additional security is provided by the so-called timestamp, as an integral part of every chain of digital signatures (Nakamoto, n.d, p. 2), granting authenticity of transactions, i.e. preventing the possibility of multiple usage of one and the same amount of bitcoins for purchasing different goods and services. Moreover, each block carries with it a certain mathematical problem that the computer has to solve. Each of the tasks can be solved in several ways, but it is sufficient to find just one in order for the transaction to be conducted. Each successfully solved task generates a certain number of bitcoins, as a reward for the computer owners who “solved the task”. At the same time, this is how bitcoins attract new users. After receiving bitcoins in respect of a transaction, a certain time period, from 10 minutes to 1 hour, is required before the recipient can actually use the concerned money. The reason behind this waiting period is the fact that it takes some time to find the transaction block chain to be verified (En.bitoin.it, n.d.). Bitcoins are generated in a computer program called Bitcoin miner.

The previously described process of realizing bitcoin transactions can be graphically presented in the following way:

Kao što Šema 1 pokazuje, svaka transakcija između dva računara u mreži zahteva verifikaciju ove transakcije od strane određenog broja računara u mreži. Nakon uspešno verifikovane transakcije dolazi do proširenja lanca digitalnih zapisa koji predstavljaju bitkojn. Oni "mining" računari koji vrše tzv. "hashing" i verifikaciju transakcija dobijaju, tj. generišu određen broj BTC kao nadoknadu za tu svoju ulogu i koji mogu koristiti po svom nahođenju. U tom smislu, trošenje električne energije i rad "mining" računara, uslovno rečeno, predstavlja realno pokriće za emitovani bitkojn. Pritom se u velikoj meri zanemaruje činjenica da vrednost utrošene električne energije i hardverskih resursa može prevazilaziti vrednost generisanih BTC valuta, pa se može postaviti pitanje ekonomske isplativosti, tj. održivosti takve valute. Kao jedan od faktora koji opravdava ove troškove može se navesti anonimnost koju korišćenje ove valute pruža. Međutim, danas se na tržištu mogu pronaći uređaji koji višestruko povećavaju kapacitet "mining" računara, tako da se "rudarenje" BTC valute može smatrati profitabilnim. Primera radi, sredstva investirana u kupovinu "GPU" (grafičkih kartica) ili "ASIC Bitcoin Miner" uređaja koji se koriste u te svrhe se mogu povratiti u roku od nekoliko meseci (Barber i saradnici 2012, p.400).

Faktor koji određuje verovatnoću da će "mining" računar pronaći blok transakcija koje treba verifikovati poznat je kao "difficulty" faktor. On u suštini predstavlja meru težine pronalaženja tog bloka (En.bitcoin.it n.d.). U slučajevima kada je relativno veliki broj računara na mreži spreman da vrši verifikaciju, ovaj faktor se povećava, i obrnuto. Uloga ovog faktora se ogleda u podsticanju korišćenja bitkojn valute onih koji bi želeli da zarade putem "rudarenja", jer se smanjenjem "difficulty" faktora povećava verovatnoća pronalaženja bloka u uslovima kada je mali broj učesnika zainteresovan da verifikuje transakcije. Sa druge strane, "difficulty" faktor se povećava u slučajevima kada je veliki broj članova mreže spreman da vrši verifikaciju naloga, kako bi se ograničila stopa monetarnog rasta u željenim okvirima (Nakamoto n.d., p.3). Vrednost "difficulty" faktora se menja nakon svakih 2016 blokova.

Pritom sama mreža, odnosno algoritam na kome se zasnivaju transakcije u bitkojn valuti,

definiše koliko bitkojna svako pojedinačno može kreirati, u skladu sa pravilom "kontrolisane ponude" (engl. "controlled supply"). Broj bitkojna koji se na ovaj način može generisati je u samom nastanku iznosio 50 BTC po bloku, dok od 2013. godine nagrada iznosi 25 BTC po bloku. Broj generisanih bitkojna po bloku transakcije biće prepolovljen na svake 4 godine, što će tokom vremena dovoditi do usporene stope rasta količine bitkojna u opticaju.

Emisija bitkojna i njeni efekti

Emisija bitkojna je u potpunosti isplanirana, odnosno programirana, i njeno upravljanje je dodeljeno samoj mreži, odnosno onim računarima koji vrše verifikaciju transakcija. Ovakav algoritam je izabran jer on u najvećoj meri aproksimira stopu rasta ekstrakcije pojedinih ruda kao što je zlato, budući da je ograničena količina bitkojna koja u jednom trenutku može postojati u sistemu i maksimalna količina koja se može „izrudariti“.

Programiranim tempom rasta količine BTC novca u opticaju određeno je da maksimalna količina emitovanih bitkojna nikada ne pređe nivo od 21.000.000 BTC. Budući da je za verifikaciju jednog bloka transakcija potrebno u proseku 10 minuta, to je ujedno i period tokom kojeg se broj bitkojna povećava za malopre pomenutih 25 (od početka 2013. godine do kraja 2017.), da bi se broj novoemitovanih BTC u jedinici vremena programirano smanjivao tokom vremena.

Međutim, primena ovakve programirane stope ograničenog i usporenog monetarnog rasta za posledicu može imati rast deviznog kursa bitkojna, kao i pad cena proizvoda izraženih u bitkojn valuti, što bi u konačnom trebalo da utiče na rast tražnje za ovom valutom. Prema nekim shvatanjima, upravo je ekspanzivna monetarna politika mnogih centralnih banaka nakon 2008. godine sa ciljem ublažavanja negativnih efekata krize i strah od inflacije jedan od najvažnijih faktora koji su uticali na relativno veliku tražnju za bitkojn valutom (Christin, Moore 2013, p.1). Po shvatanju kejnzijanaca, pad cena izraženih u jednoj valuti i istovremena apresijacija te valute može motivisati transaktoare da više štede, a manje troše, što u konačnom može imati

As illustrated by Scheme 1, each transaction between two network computers requires a verification of that transaction by a certain number of computers in the network. Following a successfully verified transaction, the chain of digital signatures representing bitcoins gets expanded. Those mining computers conducting the so-called hashing and verification of transactions receive, i.e. generate a certain amount of BTC as a compensation for their role, which they can use at their own discretion. In this context, the consumption of electrical power and the operation of mining computers, in a manner of speaking, stand as the real coverage for the issued bitcoins. However, what is largely neglected here is the fact that the value of consumed electrical power and hardware resources may exceed the value of generated bitcoins, which brings us to the issue of economic profitability, i.e. sustainability of such a currency. One of the factors that might be used to justify these costs is the anonymity that the usage of this currency provides. Nevertheless, at the today's market it is possible to find gadgets which increase the capacity of mining computers manifold, hence the mining of bitcoins can be deemed profitable. For instance, the funds invested in the purchase of graphics processing units (GPU) or ASIC Bitcoin Miner used for these purposes can be retrieved within several months (Barber et al, 2012, p. 400).

The factor determining the probability of the mining computer finding the block chain of transactions to be verified is known as the difficulty factor. It basically represents the measure of how difficult it is to find the concerned block (En.bitcoin.it, n.d.). In cases when a relatively large number of network computers are ready to conduct verification, this factor increases, and vice versa. The role of this factor is to encourage the usage of bitcoins by those who would like to profit from "mining", because the lowering of the difficulty factor raises the possibility of finding the block chain, under the conditions when a small number of participants are interested in verifying the transactions. On the other hand, the difficulty factor increases when a large number of network members are ready to perform the order verification, so that the monetary growth rate could be limited within the desired frame

(Nakamoto, n.d., p. 3). The difficulty factor's value changes after every 2016 blocks.

The network itself, i.e. algorithm on which bitcoin transactions are based, defines how many bitcoins can be generated by each individual, in line with the controlled supply rule. The number of bitcoins that could be generated in this way originally amounted to 50 BTC per block, whereas since 2013 the reward has amounted to 25 BTC per block. The number of generated bitcoins per block chain of transactions will be halved every 4 years, which will over time slow down the growth rate of the amount of bitcoins in circulation.

Issuance of Bitcoins and its Effects

The issuance of bitcoins is fully planned, i.e. programmed, and it is managed by the network itself, that is by the computers conducting the verification of transactions. Such an algorithm was chosen because it approximates to the largest extent the growth rate of the extraction of certain ores, such as gold, given the limited amount of bitcoins that can exist at one point in the system, and the maximal amount that can be "mined".

The programmed dynamics of growth of BTC in circulation determines that the maximal amount of issued bitcoins should never exceed the level of 21,000,000 BTC. Given that the verification of a single block chain of transactions takes 10 minutes on average, this is, at the same time, the period over which the number of bitcoins increased by the above mentioned 25 (from the beginning of 2013 through 2017), only for the number of newly-issued BTC per time unit to decrease in the programmed manner over time.

However, the implementation of such programmed rate of a limited and slowed down monetary growth can consequently cause appreciation of the bitcoin foreign exchange rate, and a drop in prices of products denominated in bitcoins, which should ultimately result in heightened demand for this currency. According to some opinions, the expansionary monetary policy of many central banks after 2008 with a view to mitigating the adverse effects of the crisis and the fear of inflation was one of the most significant factors

recesione efekte. Težnja ka štednji bi dovela do smanjenjog korišćenja ove valute, pa bi sve veći broj „mining“ računara napuštao mrežu, zbog čega bi došlo do ugrožavanja stabilnosti i slabljenja deviznog kursa ove valute (Barber i saradnici 2012, p.404). Sa druge strane, po shvatanju predstavnika austrijske škole, pad cena se obuhvata samo pad cena finalnih proizvoda, već i inputa, tako da ne bi trebalo da dođe do smanjenja profita i recesije (En.bitcoin.it n.d.). Koja će se shvatanja pokazati ispravnim, zavisice od niza faktora, pre svega stabilnosti i sigurnosti bitkojna kao valute.

Naime, trenutno se ova valuta može smatrati sigurnom za realizaciju transakcija, ali ne i dovoljno stabilnom u pogledu otpornosti na spekulativne udare i druge izvore nestabilnosti, budući da je trenutno njena kapitalizacija relativno mala, pa veoma mali poremećaji mogu uticati na značajna kolebanja cena i kursa. Naime, ova valuta može u velikoj meri biti podložna različitim spekulativnim napadima, budući da ne postoje regulativne odredbe i sankcije za one članove mreže koji bi trgovanjem pokušali da utiču na devizni kurs i tako ostvarili spekulativni profit i ugrozili integritet same valute. Treba imati u vidu i da su same transakcije anonimne, tako da bi se moglo postaviti pitanje određene regulacije ovih transakcija. Međutim, to bi moglo ugroziti anonimnost kao jednu od osnovnih prednosti ove valute. Sa rastom tržišta može se očekivati veći imunitet na spekulativne udare. Međutim, budući da će u narednom periodu stopa monetarnog rasta biti relativno mala, rast tržišta bi se mogao ostvariti jedino putem jačanja deviznog kursa ove valute, tj. ova valuta bi mogla postati stabilnija ukoliko bi dovoljno apresirala.

Deflaciona tendencija bi bila dodatno intenzivirana i usled delovanja sledećih faktora:

- Centralne banke svih zemalja bi u manjoj ili većoj meri povećavale količinu novca u opticaju svake godine, dok bi sa druge strane ponuda bitkojna bila relativno sporo rastuća. Pritom, treba imati u vidu da bi kurs bitkojna pre svega zavisio od tražnje za tom valutom. Iako je 2010. godine u odnosu na

početnu 2009. stopa monetarnog rasta BTC valute iznosila 100%, trenutno oko 13% na godišnjem nivou, zbog same prirode proizvoda i usluga koje se njime mogu kupiti i usled sve većeg broja kompanija koje primaju bitkojn (En.bitcoin.it n.d.) kao sredstvo plaćanja, ovaj monetarni rast ne izaziva inflaciju.

- Paralelno sa padom cena izraženih u bitkojn valuti povećavala bi se granična sklonost štednji, pa bi povećanje brzine optičaja novca, kao potencijalni faktor koji bi mogao da utiče na smanjenje deflacionih procesa, izostalo (ECB 2012, p.25).

Kalkulacijom se takođe može doći do zaključka da će već 2025. godine stopa monetarnog rasta iznositi manje od 1% (tačnije 0,83%), a 2037. godine manje od 1‰ (tj. 0,095%). Nakon čega, monetarni rast će se i dalje nastaviti zanemarljivo malim stopama, ali nikada neće preći programiranu granicu od 21.000.000 BTC. Kretanje ponude bitkojna tokom vremena je prikazan na Grafikonu 1:

Grafikon 1: Ponuda bitkojna tokom vremena

Izvor: https://en.bitcoin.it/wiki/Controlled_supply

Inače, već 2035. godine. će u opticaju biti 99% programirane gornje granice bitkojna (približno 20.800.000 BTC), tj. do 2040. godine će nestati interes za daljim „rudarenjem“ u današnjem smislu, jer bi bili potrebni ogromni resursi da bi se stvorio čak i minimalni deo jednog bitkojna. Nakon toga, predviđeno se da vlasnici „mining“ računara zarađuju po osnovu nalaćivanja transakcionih troškova za verifikovane transakcije u određenom procentu (ECB 2012, p.25), tako da se dugoročno ovaj sistem može oceniti kao održiv. Stopa monetarnog rasta tokom vremena bi se u polulogaritamskom grafikonu sa prirodnim osnovom mogla predstaviti na Grafikonu 2:

impacting the relatively high demand for bitcoins (Christin, Moore, 2013, p. 1). According to the Keynesian beliefs, a drop in prices denominated in one currency, accompanied by simultaneous appreciation of that currency may motivate transaction participants to save more, and spend less, which may ultimately cause recession effects. A tendency towards savings would cause a reduced usage of this currency, with the increasing number of mining computers leaving the network, thereby jeopardizing stability and leading to depreciated foreign exchange of this currency (Barber et al, 2012, p. 404). On the other hand, according to the opinion of the Austrian School economists, a drop in prices refers not only to the drop in prices of final products, but also of inputs, which is why there should not be any reductions in profit or any recessions (En. bitcoin.it, n.d.). Which of these lines of thought will prove right, depends on a series of factors, first and foremost the stability and security of bitcoins as a currency.

Namely, at the moment this currency can be considered safe for the realization of transactions, but not sufficiently stable in terms of its resilience to speculative shocks and other sources of instability, given that currently its capitalization is relatively small, which is why even extremely small turbulences may cause substantial fluctuations in prices and FX rate. Specifically, this currency may, to a large extent, be susceptible to various speculative shocks, bearing in mind that there are no regulatory provisions and sanctions for those network members who would try to impact the FX rate through trading, thereby achieving speculation profit and jeopardizing the integrity of the currency itself. What should also be taken into consideration is that transactions themselves are anonymous, which could raise the issue of certain regulation of these transactions. However, that could compromise anonymity, as one of the major advantages of this currency. As the market develops, one could expect stronger immunity to speculative shocks. Nevertheless, given that in the forthcoming period the monetary growth rate will be

relatively low, the market expansion could only be achieved through strengthening the FX rate of this currency, meaning that this currency could become more stable if it appreciates to a sufficient degree.

Deflationary trends would be additionally intensified due to the impact of the following factors:

- Central banks of all countries would, more or less, increase the amount of money in circulation every year, whereas on the other hand the supply of bitcoins would be relatively slow-increasing. At the same time, one should bear in mind that the bitcoin FX rate would primarily depend on the demand for this currency. Although in 2010, compared to the initial 2009, the monetary growth rate of BTC amounted to 100%, at the moment amounting to 13% annually, due to the very nature of products and services that can be purchased with bitcoins, and due to the increasing number of companies accepting bitcoins (En.bitcoin.it, n.d.) as a means of payment, such monetary growth does not cause inflation.
- In parallel with a drop in prices denominated in bitcoins, the marginal propensity to save would increase, and the upsurge in the velocity of money, as a potential factor that could reduce deflationary processes, would be lacking (ECB, 2012, p. 25).

By effecting a relevant calculation, one comes to the conclusion that already in 2025 the monetary growth rate will amount to less than 1% (more precisely 0.83%), and in 2037 less than 1‰ (i.e. 0.095%). After that, monetary growth will continue at a negligibly low rate, but will never exceed the programmed limit of 21,000,000 BTC. The movements of bitcoins supply over time are illustrated in Graph 1 below:

Graph 1: Supply of bitcoins over time

Source: https://en.bitcoin.it/wiki/Controlled_supply

Grafikon 2: Stopa monetarnog rasta bitkojn valute

Izvor: https://en.bitcoin.it/wiki/Controlled_supply

Inače, broj generisanih bitkojna dnevno koje jedan pojedinac može ostvariti po osnovu “mining” aktivnosti je implementiran u samom kodu bitkojn valute i određuje se po sledećoj formuli (Bitcoin.stackexchange.com 2011):

$$X = ((H * B) / D) * 60 * 60 * 24 * \frac{(2^{16} - 1) * 10^6}{2^{48}}$$

Ukoliko bismo uprostiti ovu formulu time što bismo deo formule sačinjen od više konstanti sveli na jedan realan broj

$$60 * 60 * 24 * \frac{(2^{16} - 1) * 10^6}{2^{48}} \approx 20,11626$$

dobili bismo njenu skraćenu verziju:

$$X \approx ((H * B) / D) * 20,11626$$

U ovom izrazu značenje parametara je sledeće:

- X predstavlja broj generisanih bitkojna,
- D predstavlja trenutni „difficulty“ faktor,
- H predstavlja trenutni „hash-rate“, odnosno brzinu kojom konkretan uređaj koji pojedinac poseduje vrši „rudarenje“,
- B predstavlja nagradu u bitkojnima za realizovan blok transakcija,
- 20,11626 predstavlja konstantu u formuli.

Kao što se može zapaziti, pored toga što zarada po osnovu “mining” procesa zavisi od tzv. “difficulty” faktora, predviđene brzine stvaranja BTC u jedinici vremena (trenutno iznosi 25 BTC po jednom bloku, odnosno na svakih 10-ak minuta), ovaj proces zavisi od brzine kojom računari vrše “rudarenje”. Brzina se izražava u h/s (engl. “hash per second”), odnosno u Mh/s ili Gh/s. Na osnovu kalkulacija se može zaključiti da zarada i brzina otplate po osnovu “mining” procesa zavisi od

kvaliteta uređaja koji se koristi za taj proces. Inače, zarada po osnovu korišćenja klasičnih grafičkih kartica koje su se do nedavno koristile za ovaj proces je trenutno neuporedivo manja (nekoliko desetina do nekoliko hiljada puta) u odnosu na najsavremenije uređaje za “rudarenje” (En.bitcoin.it n.d.)).

Budući da se tokom narednih godina može očekivati povećanje “difficulty” faktora (u skladu sa dosadašnjom tendencijom (Bitcoinx.com n.d.)) i smanjenje broja generisanih bitkojna po bloku transakcija, profitabilnost će se, pod pretpostavkom nepromenljivog kursa i nepromenjenih cena uređaja za “rudarenje” i električne energije višestruko smanjivati.

U Tabeli 1 su prikazani osnovni statistički podaci o bitkojn valuti na dan 22.03.2013. i na dan 30.08.2013. godine:

Tabela 1. Opticaj bitkojna u BTC i USD

Opis	Datum	
	22.03.2013.	30.08.2013.
BTC u opticaju	10.934.100 BTC	11.627.875 BTC
Tržišna kapitalizacija	781.897.491 USD	1.407.786.826 USD
Broj transakcija (poslednja 24h)	57.199	61.362

Izvor: <http://bitcoincharts.com/>

Kao što se može zapaziti, u odnosu na period pre 5 meseci, došlo je do povećanja bitkojn novčanih jedinica u opticaju, što je i očekivano, budući da je u pitanju programiran proces. Takođe, došlo je do povećanja tržišne kapitalizacije BTC valute, što je pre svega posledica njene apresijacije. Uvećanje kapitalizacije tokom vremena od samog nastanka 2009. godine, a naročito tokom 2013. godine, kako usred povećanja broja bitkojna, tako i usled apresijacije njegovog deviznog kursa može se uočiti sa Grafikona 3:

Already in 2035, 99% of the programmed ceiling for bitcoins will be in circulation (approximately 20,800,000 BTC), i.e. by 2040 there will be no interest for further mining in the sense it has today, because huge resources would be required to generate even the minimal segment of one bitcoin. After that, it is envisaged for the owners of mining computers to profit based on charging transaction costs for the verified transactions in a certain percentage (ECB, 2012, p. 25), so that, in the long run, this system may be assessed as sustainable. The natural semi-logarithm of the monetary growth rate over time is illustrated in Graph 2 below:

The number of daily generated bitcoins that an individual can achieve from his mining activity is implemented in the very code of the bitcoin currency, and is calculated according to the following formula (Bitcoin.stackexchange.com, 2011):

$$X = ((H * B) / D) * 60 * 60 * 24 * \frac{(2^{16} - 1) * 10^6}{2^{48}}$$

If we simplified this formula by reducing its segment consisting of several constants into a single, real number

$$60 * 60 * 24 * \frac{(2^{16} - 1) * 10^6}{2^{48}} \approx 20,11626$$

we would get its abbreviated version:

$$X \approx ((H * B) / D) * 20,11626$$

In the above formula, the parameters imply the following:

- X is the number of generated bitcoins;
- D is the current difficulty

factor;

- H is the current hash-rate, i.e. the speed at which the concrete device owned by the individual performs the mining;
- B is the reward in bitcoins for the realized block chain of transactions;
- 20.11626 is the constant in the formula.

As can be observed, in addition to the fact that earnings in respect of the mining process depend on the so-called difficulty factor, and the anticipated speed of generating BTC within a time unit (currently 25 BTC per block, i.e. about every 10 minutes), this process also depends on the speed of mining conducted by the computers. The speed is measured in h/s (i.e. hash per second), in Mh/s or Gh/s. Based on the calculations, it can be concluded that the earnings and speed of repayment in respect of the mining process depend on the quality of computers used for that purpose. The earnings made by means of the classic GPUs which were until recently used for this process are at the moment incomparably lower (from several dozen to several

thousand times), compared with the state-of-the-art mining computers (En.bitcoin.it, n.d.).

Given that in the forthcoming years one may expect an increase in the difficulty factor (in line with the tendency expressed so far (Bitcoinx.com, n.d.)) and a reduction in the number of generated bitcoins per chain block of transactions, under the assumption of stable FX rate and unchanged prices of mining computers and electricity, there will be a multiple decrease of profitability.

The Table 1 below shows the main statistical data on bitcoins as of 22.03.2013 and 30.08.2013:

Table 1: Circulation of bitcoins in BTC and USD

Description	Date	
	22.03.2013	30.08.2013
BTC in circulation	10.934.100 BTC	11.627.875 BTC
Market capitalization	781.897.491 USD	1.407.786.826 USD
Number of transaction (in the last 24h)	57.199	61.362

Source: <http://bitcoincharts.com/>

Grafikon 3: Tržišna kapitalizacija emitovanih bitkojna

Izvor: <http://blockchain.info/charts/market-cap>

Može se reći da BTC valutni sistem ima određene sličnosti sa zlatnim standardom, jer postoji gornja granica rasta količine valute u opticaju, tako da, slično sistemu zlatnog važenja, može postati kočnica daljem razvoju, budući da onemogućuje povećanje tražnje putem povećanja količine novca u opticaju. Povezano sa pravilom “kontrolisane ponude”, poželjno je naglasiti da je čak i sam Milton Fridman smatrao da je monetarnu politiku programirane ili konstantne stope monetarnog rasta moguće uspešno implementirati pomoću računara (Econlib.org 2006). Inače, pristalice bitkojna kritikuju sistem frakcionih rezervi. Takođe, smatraju da je nastanak ove valute početni korak u ukidanju monopola centralne banke kao ekskluzivnog emitenta novca (ECB 2012, p.22). Postoje i shvatanja da je kreator ove valute kao inspiraciju imao zlatni standard. Međutim, ono po čemu se ovaj sistem razlikuje od zlatnog standarda jeste nedostatak unutrašnje, tj. materijalne vrednosti koja je svojstvena robnom novcu kao što su to plemeniti metali, dok bitkojn poseduje samo funkcionalnu vrednost koja zavisi od njegove kupovne snage.

Postoje, međutim, i shvatanja da bitkojn valuta u suštini funkcioniše kao Ponzijeva šema, budući da onima koji ranije počnu sa njenim korišćenjem pruža mogućnost ostvarenja značajnog profita ukoliko prodaju svoje bitkojne u uslovima rasta cena. Međutim, kao razlike ovog sistema u odnosu na Ponzijevu šemu možemo izdvojiti (ECB 2012, p.27):

- Ne postoji očekivani finansijski prinos koji se može ostvariti niti se prilikom

prvog korišćenja bitkojn valute potpisuje ugovor koji garantuje visok prinos, čak ni za početne ulagače. U praksi, profit se može ostvariti kako po osnovu rudarenja, čime nastaju novi bitkojni, tako i po osnovu jačanja deviznog kursa ove valute. Međutim, taj profit je neizvestan, pre svega komponenta koja se odnosi na apresijaciju deviznog kursa.

- Ne postoji centralna institucija ili kompanija koja bi mogla da pokupi novac od korisnika

sistema i „nestane“. Iako u praksi oni koji su prvi počeli da „rudare“ uspevaju da najviše i zarade, svaki profit ostvaren po osnovu „rudarenja“ i kasnijeg izlaska iz sistema bi se pre mogao okarakterisati kao spekulacija („kupiti jeftino, prodati skupo“) nego Ponzijeva šema. Međutim, u praksi je ipak postojao primer koji demantuje ovaj argument, a u pitanju je slučaj kompanije „Bitcoin Savings and Trust“ (“BTCST”) koja je tokom 2011. i 2012. godine koristeći klasičnu Ponzijevu šemu proneverila novac svojih korisnika. Ipak, ovaj primer se može oceniti samo kao izuzetak, odnosno kao zloupotreba sistema, ali ne i kao dokaz da bitkojn valuta funkcioniše kao Ponzijeva šema.

Devizni kurs bitkojna

Devizni kurs bitkojna se, kao i u slučaju bilo koje druge valute formira na berzi, na bazi sučeljavanja ponude i tražnje za tom valutom. U odnosu na početak godine kada je BTC/USD kurs iznosio približno 13, krajem avgusta je vrednost bitkojna prema američkom dolaru približno 10 puta veća i BTC/USD kurs iznosi oko 130. Očigledno je da 1 BTC ima višestruko veću vrednost od bilo koji zvanične svetske valute, pri čemu se njegova vrednost uglavnom izražava u USD, budući da se na bitkojn berzama najveći deo bitkojna razmeni za američki dolar.

Krajem avgusta se u opticaju nalazi ukupno skoro 12 miliona BTC, pri čemu njihova ukupna vrednost izražena u USD približno iznosi preko 1,4 milijarde USD. Konkretno, to

As can be observed, compared to the period 5 months ago, there was an increase in bitcoin monetary units in circulation, which had been expected, given that the concerned process is programmed. Moreover, the market capitalization of BTC also increased, mostly as a consequence of its appreciation. The increase of capitalization over time, from the BTC origination in 2009, and especially in 2013, both due to the increased number of bitcoins, and due to the appreciation of their FX rate, can be seen in Graph 3 below:

One may say that the BTC currency system shares certain similarities with the gold standard, because there is the ceiling for growth of the amount of currency in circulation, so that, similarly to the gold standard system, this can hinder further development, given that it makes it impossible for demand to be increased through increasing the amount of money in circulation. Regarding the controlled supply rule, it should be underlined that Milton Friedman himself believed that monetary policy of a programmed or constant monetary growth rate can be successfully implemented by using computers (Econlib.org, 2006). Besides that, the advocates of bitcoin criticize the system of fractional reserves. They also believe the creation of this currency to be the first step in abolishing the monopoly of a central bank as the exclusive issuer of money (ECB, 2012, p. 22). According to some other opinions, the creator of this currency was actually inspired by the gold standard. However, what makes this system different from the gold standard is the lack of intrinsic,

i.e. material value, which is characteristic for commodity money such as precious metals, whereas bitcoins only have the functional value depending on their purchasing power.

Some are, however, of the opinion that the bitcoins currency actually functions as a Ponzi scheme, given that those who start to use it early get the possibility of yielding considerable profit if they sell their bitcoins while the prices are rising. Nevertheless, the following differences of this system compared to the Ponzi scheme can be hereby underlined (ECB, 2012, p. 27):

- There is no expected financial revenue that can be achieved, and there is no contract signed on the occasion of first usage of bitcoins, guaranteeing high revenues, not even for initial investors. In practice, profit can be achieved both in respect of the mining activity, which generates new bitcoins, and in respect of appreciation of this currency's FX rate. However, this profit is uncertain, especially the component referring to the foreign exchange rate appreciation.
- There is no central institution or company that could collect the money from system users and just "disappear". Even though, in practice, those who first started to "mine" manage to profit the most, every profit yielded in respect of "mining" and subsequent exit from the system could rather be characterized as speculation ("buy cheap, sell expensive") than as a Ponzi scheme. Nonetheless, there has been an example in practice denying this argument, i.e. the case of the company "Bitcoin Savings and Trust" ("BTCST"), which in 2011 and 2012, using the classic Ponzi scheme, embezzled the money of its clients. Still, this example can be assessed as an exception, i.e. as an abuse of the system, but not as proof that the bitcoin currency functions as a Ponzi scheme.

Foreign Exchange Rate of Bitcoins

Foreign exchange rate of bitcoins, just like in the case of any other currency, is determined

znači da je ukupna vrednost svih emitovanih bitkojna nominalno veća od bruto društvenog proizvoda pojedinih zemalja. Budući da je cena zlata približno 50 USD/g, možemo zaključiti da 1 bitkojn vredi nešto više od 2,5 grama zlata. Prevedeno u RSD po kursu od približno 85 RSD/USD, za kupovinu jednog bitkojna je na dan 29.08.2013. godine potrebno više od 11.000 RSD. Pritom, 1 bitkojn je jednak 100.000.000 „satoshis“-a (naziv „satoshis“ potiče od pseudonima Satoshi Nakamoto, tj. pseudonima kreatora ili grupe ljudi koji su stvorili bitkojn).

Inače, kurs bitkojna zavisi od ponude i tražnje za ovom valutom. Kretanje srednjeg ponderisanog dnevnog kursa BTC valute u odnosu na USD može se uočiti na osnovu Grafikona 4:

Grafikon 4: Kurs BTC/USD u periodu 01.01.2013.-29.03.2013.

Izvor: <http://bitcoincharts.com/charts/mtgoxUSD>

Na osnovu dostupnih podataka od početka 2013. godine statističkom analizom može se doći do zaključka da linearna funkcija trenda najbolje opisuje kretanje vrednosti BTC valute. Ocenjena linearna funkcija trenda glasi:

$$\text{BTC/USD} = 27.95 + 0.45t$$

pri čemu je bazni period 1. januar 2013. godine, a to je ceo broj koji predstavlja broj dana nakon 1. januara. Međutim, budući da je koeficijent determinacije svega $r^2 = 0.52$, ocenjena funkcija trenda se ne može primeniti za ekstrapolaciju, odnosno ne bismo mogli sa velikim stepenom sigurnosti da procenimo kretanje vrednosti bitkojna u budućnosti. Ovako nizak koeficijent determinacije ukazuje na činjenicu da je devizni kurs bitkojna veoma nestabilan. Nestabilnosti deviznog kursa bitkojna u velikoj meri doprinosi i podložnost različitim šokovima, o čemu će više reči biti kasnije.

Prednosti i nedostaci bitkojn valute

Kao osnovne prednosti bitkojna u odnosu na ostale, kako nacionalne, tako i alternativne valute, obično se navode:

- Za razliku od transakcija klasičnim elektronskim novcem koji se nalazi na računima banaka, u slučaju bitkojna ne postoje transakcioni troškovi ili su oni svedeni na minimum, dok sa druge strane ne postoji ograničenje u pogledu minimalnog iznosa transakcije koju je moguće realizovati (Nakamoto n.d., p.1).

- Kontrolu transakcija i emisiju BTC valute vrše kompjuterski algoritmi, čime se onemogućava pojava veštački izazvane inflacije. Takođe, ovom verifikacijom se izbegava "duplo plaćanje" (engl. "double-spending"), čime bi se mogao zloupotrebiti sistem (Bitcoin.org/en/about n.d.) i nekontrolisano povećavala količina novca u opticaju. Sigurnost plaćanja je pritom zasnovana na korišćenju kriptografije.

- Praktično je gotovo nemoguće falsifikovati bitkojn. Teoretski, to bi bilo moguće ukoliko bi se isti BTC iskoristio za istovremeno

obavljanje dva plaćanja. Međutim, lanac digitalnih potpisa onemogućava takve transakcije (Stanford Bitcoin Group n.d.).

- Omogućena je potpuna anonimnost transaktora. Međutim, iako ovo predstavlja pogodnost za određene grupe ekonomskih subjekata, sa aspekta poreskih i regulatornih organa ova osobina bitkojna bi se definitivno mogla oceniti kao njen nedostatak. Za razliku od elektronskog novca u platnom prometu kod kojeg su informacije o učesnicima u transakciji javnog, a informacije o transakcijama privatnog karaktera, u slučaju bitkojn valute su informacije o transaktorima privatnog karaktera, tj. veoma često ni samim transaktorima nije poznato kome vrše plaćanja, dok su same karakteristike realizovane transakcije javnog karaktera.

Sa druge strane, kao neke od osnovnih nedostataka bitkojn valute možemo izdvojiti sledeće:

at the stock exchange, based on the supply and demand of the concerned currency. Compared to the beginning of the year, when the BTC/USD rate amounted to almost 13, in late August the value of bitcoin against the US dollar was approximately ten times higher, with the BTC/USD rate amounting to about 130. Obviously, 1 BTC has a several times higher value than any official currency in the world, its value mostly being expressed in USD, given that at the bitcoin stock exchanges most bitcoins get exchanged for the US dollar.

In late August there was a total of almost 12 million BTC in circulation, their total value expressed in USD approximately amounting to over 1.4 billion USD. In particular, this means that the total value of all issued bitcoins is nominally higher than the gross domestic product of certain countries. Bearing in mind that the price of gold is about 50 USD/g, we may conclude that 1 BTC is worth somewhat more than 2.5 grams of gold. Converted into RSD at the rate of approximately 85 RSD/USD, for the purchase of one bitcoin as of 29.08.2013 it was required over 11,000 RSD. Moreover, 1 BTC equals 100,000,000 satoshis (the name “satoshi” was given after the pseudonym of Satoshi Nakamoto, i.e. the pseudonymous creator or group of people who created bitcoins).

The bitcoin FX rate depends on the supply and demand for this currency. Movements of the middle weighted daily FX rate of BTC against USD can be followed at the Graph 4 below:

Based on the available data from early 2013, by means of a statistical analysis, one may come to the conclusion that a linear function of the trend best describes the movements of BTC

values. The estimated linear function of the trend is as follows:

$$\text{BTC/USD} = 27.95 + 0.45t$$

with the basis period being 1 January 2013, and t the round number representing the number of days after 1 January. However, given that the determination coefficient is only $r^2 = 0.52$, the estimated function of the trend cannot be applied for extrapolation, meaning that we could not, with a high degree of certainty, assess the movements of bitcoin values in the future. Such a low determination coefficient indicates the fact that the bitcoin FX rate is extremely unstable. What largely contributes to the instability of the bitcoin FX rate is its susceptibility to various shocks, which we will subsequently elaborate on.

Advantages and Disadvantages of Bitcoins

The following are typically listed as the basic advantages of bitcoins compared to other both national and alternative currencies:

- As opposed to transactions using the classic electronic money at the bank accounts, in case of bitcoins there are no or minimum transaction costs, with, on the other hand, no limits in terms of the minimal transaction amount which can be realized (Nakamoto, n.d., p. 1).
- Transactions and BTC issuance are controlled by computer algorithms, preventing the occurrence of artificially generated inflation. Moreover, such verification enables the avoidance of double-spending, which can otherwise lead to system abuses (Bitcoin.org/en/about, n.d.) and uncontrollable growth of money in circulation. The security of payments is based on using cryptography.
- It is practically impossible to counterfeit bitcoins. Theoretically speaking, that would be possible if the same BTC would be used for conducting two payments simultaneously. However, the chain of

- Bitkojn nije široko prihvaćen kao sredstvo plaćanja. Naime, veoma je mali broj privrednih subjekata koji primaju bitkojn za prodaju robe, odnosno pružanje usluga. Iako je broj ovih subjekata sve veći, uloga bitkojna kao sredstva plaćanja je još uvek veoma ograničena. Razlog ovoj pojavi leži kako u činjenici da postoji niz proizvoda koji se ne mogu kupiti za bitkojn, tako i u činjenici da ova valuta ne postoji u svojoj fizičkoj verziji, tako da se može koristiti jedino za elektronska plaćanja.
- Devizni kurs bitkojna je veoma nestabilan. Tome u velikoj meri doprinosi i nepostojanje centralnog entiteta poput centralne banke koja bi putem intervencija na deviznom tržištu ili nekom drugom merom monetarne politike mogla pozitivno da utiče na njegovu stabilizaciju.
- Transakcije bitkojn valutama nisu reverzibilne, što znači da nije moguće poništiti već realizovanu transakciju. Iako se ova osobina bitkojn valute može smatrati njenim nedostatkom, značajno je zapaziti da bitkojn u suštini više liči na keš nego na elektronski novac, pa samim tim nema nikakvu mogućnost poništavanja transakcija, jer po definiciji ne postoji sistem za praćenje toka novca. Drugim rečima, transakcije realizovane elektronskim novcem koji se nalazi na računima banaka se mogu poništiti u određenom roku. Sa druge strane, u najvećem broju slučajeva gotovinu potrošenu u prodavnici uglavnom nećemo moći da povratimo, osim ukoliko nije u pitanju roba sa garancijom i sl. Upravo u ovome i leži jedan od najvećih problema vezan za korišćenje bitkojn valute, a koji se odnosi na teškoće prilikom povraćaja novca u slučaju kupovine neispravnih proizvoda bez adekvatno regulisane garancije. Sa druge strane, ovo je odličan mehanizam zaštite prodavaca od zloupotreba, jer im ovaj mehanizam omogućuje sigurnu i momentalnu naplatu svojih potraživanja po osnovu prodate robe (Nakamoto n.d., p.1). Vezano za reverzibilnost transakcija, značajno je naglasiti da je osnovni uzrok ove osobine bitkojna činjenica da, u opštem slučaju, ne postoji posrednik u plaćanju, odnosno, sve plaćanja se vrše direktno između tržišnih

subjekata. Iako se nererzibilnost može oceniti kao nedostatak bitkojna, treba imati u vidu da nepostojanje posrednika za posledicu ima nepostojanje provizija koje bi u suprotnom naplaćivale banke ili drugi posrednici u platnom prometu. Međutim, ne treba zanemariti činjenicu da postoje opcione provizije koje plaćaju oni koji žele da transakcija u bitkojn valuti bude brže realizovana (Stanford Bitcoin Group n.d.).

- Iako je reč o vidu elektronskog novca, postoji mogućnost njegovog gubitka. Naime, jedna od specifičnosti ove valute jeste da ona postoji samo u svojoj elektronskoj verziji. Pritom se nalog koji se koristi za plaćanja razlikuje od klasičnog transakcionog računa u banci po tome što ne postoji institucija poput banke koja bi transaktorima zatvorila ili blokirala nalog. Takođe, ne postoje nikakva ograničenja u pogledu korišćenja bitkojna. Nalog mogu deaktivirati sami korisnici sistema time što bi prestali da ga koriste i time što bi se oslobodila svih BTC valuta na svom nalogu. Nalog se inače gubi i ukoliko se prilikom oporavka operativnog sistema na računaru ne obezbedi skladištenje (engl. "backup") bitkojna. Time se faktički taj novac trajno gubi iz sistema. U tome se faktički i ogleda sličnost između bitkojn valute i običnog novca, budući da on praktično može biti izgubljen ili uništen (Kaplanov 2012, p.116). Međutim, za razliku od običnog novca koji može biti dodatno otštampan od strane centralne banke, u slučaju bitkojna ne postoji entitet koji bi emitovao novu količinu novčanih jedinica koje bi zamenile nestale ili uništene bitkojne.
- Kao poslednji nedostatak bitkojna bismo mogli navesti sve one probleme koji se odnose na zloupotrebe kojima je on podložan, a koji se odnose na mogućnost obavljanja nelegalnih aktivnosti, pranje novca, stvaranja "crnih tržišta", ali i poreskih rajeva, mogućnost poreske evazije, ali i neotpornost na različite napade kompjuterskih virusa itd.

Korišćenje BTC valute se preporučuje manjim kompanijama i preduzetnicima, budući da im omogućuje prodaju proizvoda i njihovu naplatu uz niže transakcione troškove, tj. bez provizija različitih finansijskih institucija,

digital signatures thwarts such transactions (Stanford Bitcoin Group, n.d.).

- Transaction participants are granted full anonymity. However, although this represents an advantage for certain groups of economic entities, from the aspect of fiscal and regulatory authorities this characteristic of bitcoins could definitely be assessed as their drawback. As opposed to e-money in the payment system, in case of which information about transaction participants is public, and information about transactions private, in case of bitcoins information about transaction participants is private, with transaction participants often not knowing themselves to whom they effect the payments, whereas the characteristics of realized transactions remain public.

On the other hand, as some of the main disadvantages of bitcoins we can single out the following:

- BTC is not widely accepted as a means of payment. Namely, only a few business entities accept bitcoins when selling their goods, or providing services. Although the number of these entities has been increasing, the role of bitcoins as a means of payment is still rather limited. The reason for this lies both in the fact that there is a series of products that cannot be purchased for bitcoins, and in the fact that this currency does not exist in its physical, material version, which is why it can only be used for e-payments.
- The bitcoin FX rate is extremely volatile. What largely contributes to this is the lack of a central entity, like a central bank, which could, by means of its interventions at the FX market or some other monetary policy measure, facilitate its stabilization.
- BTC transactions are non-reversible, which means that it is impossible to cancel an already realized transaction. Despite the fact that this characteristic of bitcoins can be considered their drawback, it is important to note that bitcoins are essentially more like cash than e-money, hence there is no possibility whatsoever of cancelling transactions, given that, by definition, there is no system for cash flows monitoring. In other words, transactions realized with e-money deposited at bank accounts can be cancelled within a certain deadline. On the other hand, in the majority of cases we will not be able to retrieve the cash spent in a store, unless we spent it to purchase goods with a guarantee. This is exactly where we are facing one of the biggest problems in the usage of bitcoins, the one concerning difficulties in retrieving money in case of defective products purchased without an adequately regulated guarantee. Yet, this is an excellent mechanism of protecting sellers from potential abuses, because this mechanism enables them a safe and prompt collection of their receivables in respect of the sold goods (Nakamoto, n.d., p. 1). When it comes to reversibility of transactions, it is important to underline that the main cause of this BTC feature is the fact that, generally speaking, there are no intermediaries in payments, i.e. all payments are effected directly between market entities. Although non-reversibility can be considered a shortcoming of bitcoins, one should bear in mind that the absence of intermediaries results in no fees that would have otherwise be charged by banks or other payment system intermediaries. Nevertheless, one should not neglect the fact that there are optional fees paid by those wishing for a bitcoin transaction to be realized more quickly (Stanford Bitcoin Group, n.d.).
- Even though bitcoins are a type of e-money, there is a possibility of their loss. Namely, one of the specificities of this currency is that it exists only in its electronic version. Besides, payment orders differ from classic transaction accounts in banks, because there is no bank-like institution that would close or block the orders of transaction participants. Moreover, there are no limits whatsoever in terms of using bitcoins. An order can be deactivated by system users themselves, if they stop using it and if they get rid of all bitcoins on their account. An account is also lost if no back-up of bitcoins is provided in the process of recovering a computer's operating system. In fact, that money is thereby permanently gone from the system. This is where the essential similarity between bitcoins and regular money lies, given that

kao i zahvaljujući činjenici da je veoma lako implementirati ovaj oblik prodaje i naplate prodaje putem Interneta. Međutim, time se može dovesti u pitanje legalnost obavljanja takvih aktivnosti, naročito kada je reč o prodaji digitalnih proizvoda (softvera, muzike,...) koji se mogu neograničen broj puta umnožavati i prodavati bez ikakve evidencije, čime se može izbeći izvršenje poreske obaveze.

Finansijske institucije koje posluju sa bitkojnim

Trenutno postoji oko 50 aktivnih berzi na kojima se zvanične valute mogu razmeniti za bitkojn, od kojih je najznačajnija "MtGox" na kojoj se dnevno razmeni oko 64% ukupnog prometa bitkojn valutom za ostale zvanične valute i obrnuto. Inače, bitkojn se najviše razmenjuje za USD (74%) i EUR (14%), dok je značaj svih ostalih valuta zanemarljiv (Bitcoincharts.com n.d.). Inače, statistička analiza aktivnih i ugašenih bitkojn berzi je pokazala nekoliko zakonitosti (Christin, Moore 2013, p.7):

- Sa povećanjem prometa na nekoj berzi smanjuje se verovatnoća da će doći do njenog zatvaranja
- S druge strane, što je promet na nekoj berzi veći, postojaće i veća šansa da dođe do različitih oblika zloupotreba i prekršaja.

Pritom treba imati u vidu da je u ovoj analizi apstrahovan niz faktora koji bi potencijalno mogli da utiču na dobijanje drugačijih rezultata. Primera radi, nije uzeta u obzir reputacija samih berzi, odnosno činjenica da će atraktivnost same berze zavisiti od sigurnosti koju ona pruža svojim korisnicima.

Takođe, iako je kao jedna od osnovnih karakteristika kriptovaluta, a samim tim i bitkojna, navedena činjenica da ovakve valute u opštem slučaju funkcionišu bez posredovanja finansijskih institucija, ne treba zanemariti činjenicu da se marta 2013. godine pojavio prvi hedž fond „Exante“ koji investira u bitkojn. Treba međutim naznačiti da ovaj fond ima širok portfolio aktivnosti, pri čemu su operacije sa bitkojnom samo jedna od njih. Fond kao naknadu za svoje usluge ne naplaćuje procentualni deo ostvarenog profita, već fiksnu proviziju od 0,5% neto vrednosti Bitcoin Fund-a. Pritom, ovaj fond ogroman akcenat

stavlja na zaštitu podataka i sigurnost fonda. Marta 2013. godine vrednost fonda je iznosila približno 3,2 miliona USD. Inače, za pristup fondu su neophodna inicijalna ulaganja od minimum 100.000 USD (Forbes.com 2013). Ovaj fond ostvaruje zaradu po osnovu kapitalnih dobitaka na kupljene bitkojne, pri čemu jedna akcija ovog fonda vredi tačno jedan BTC. S obzirom na vrtoglavi rast vrednosti bitkojn valute očekuju se visoki prinosi po osnovu plasmana ovog fonda. Kao osnovne prednosti investiranja u fond umesto direktne kupovine BTC valute navode se (Exante.eu/press/news 2013[a]):

- Lakše je kupiti akcije/investicione jedinice fonda nego bitkojn.
- Sredstva investirana u fondove umesto u direktnu kupovinu bitkojn valute se smatraju sigurnijim, budući da takvi fondovi, između ostalog i Exante, značajan akcenat stavljaju na kriptografsku sigurnost sredstava svojih korisnika.

Inače, od juna 2013. godine ovaj fond svojim klijentima nudi „Automatic Trading Platform“ (ATP), odnosno elektronsku platformu za trgovinu koja im omogućuje niz usluga koje se, između ostalog, odnose na različite statističke alate i portfolio menadžment (Exante.eu/press/news 2013[b]).

Međutim, ovaj fond nije prva finansijska institucija koja je radila sa bitkojn valutom. Naime, ne treba zaboraviti ni na „Bitcoin Savings and Trust“ ("BTCST") kompaniju koja je, koristeći klasičnu Ponzijevu šemu, od 2011. do septembra 2012. godine prikupila oko 700.000 BTC (vrednih više od 4,5 miliona USD) od svojih klijenata obećavši im nedeljne stope prinosa od čak 7%, a zatim taj novac proneverila. Tim povodom je jula 2013. godine američka "Komisija za hartije od vrednosti i berzu" (engl. "Securities and Exchange Commission" - SEC) optužila ovu kompaniju i Trendon Shaversa, njenog osnivača (Wang 2013).

Takođe, postoje i najave da će vlasnici BTC valute moći da na realnim bankomatima da povlače zvaničan novac čiji je emitent centralna banka u ekvivalentnom iznosu (eventualno umanjenom za određenu proviziju), kao i da će se moći koristiti prilikom kupovine u prodavnicama na POS terminalima (Newscientist.com 2012).

they can both practically be lost or destroyed (Kaplanov, 2012, p. 116). Nevertheless, as opposed to regular money which may be additionally printed by the central bank, in case of bitcoins there are no entities that would issue new quantities of monetary units to replace the lost or destroyed bitcoins.

- As the final shortcoming of bitcoins, we could mention all those problems related to abuses it is susceptible to, referring to the possibility of performing illegal activities, money laundering, creation of “black markets”, but also of tax havens, possibility of tax evasion, and non-resilience to various computer viruses attacks, etc.

Usage of BTC is recommended to small enterprises and entrepreneurs, given that it enables them to sell products and charge them with lower transaction costs, i.e. without any fees by different financial institutions, and also in light of the fact that this form of sales and collection via the Internet is extremely easy to implement. However, this many bring into question the legality of such activities, especially when it comes to selling digital products (software, music, etc.), which can be reproduced countless times and sold without any records, thereby enabling the evasion of tax obligations.

Financial Institutions Dealing in Bitcoins

Currently there are about 50 active stock exchanges at which official currencies can be exchanged for bitcoins, the most important of which is “MtGox” at which about 64% of total bitcoins turnover gets exchanged on a daily basis for other official currencies, and vice versa. Bitcoins are most frequently exchanged for USD (74%) and EUR (14%), the significance of all other currencies being negligible (Bitcoincharts.com, n.d.). Statistical analysis of active and closed bitcoin exchanges has indicated several rules (Christin, Moore, 2013, p. 7):

- The higher the turnover on a stock exchange, the lower the probability of its closure.
- On the other hand, the higher the turnover on a stock exchange, the higher the chances for various forms of abuses and violations. One should bear in mind that in this analysis

several factors, which could have potentially led to different results, were abstracted. For instance, the reputation of stock exchanges themselves was disregarded, i.e. the fact that the attractiveness of a stock exchange depends on the safety it provides to its users.

Moreover, although one of the main characteristics of cryptocurrencies, and thereby bitcoins, is the fact that such currencies generally function without any intermediation by financial institutions, one should bear in mind that in March 2013 “Exante”, the first hedge fund investing in bitcoins, appeared at the market. Yet, it should be underlined that this fund has a wide-ranging portfolio of activities, with bitcoin operations being just one of them. As a compensation for its services, the fund does not charge a percentage of the achieved profit, but a fixed fee amounting to 0.5% of the net value of Bitcoin Fund. The fund places huge importance on data protection and the fund’s security. In March 2013 the fund was worth approximately 3.2 million USD. To access the fund, an initial investment of minimum 100,000 USD is required (Forbes.com, 2013). This fund achieves profit in respect of capital gains from purchased bitcoins, with one share of this fund being worth exactly one BTC. Taking into account the rapid appreciation of bitcoins, huge revenues are expected in respect of this fund’s placements. The following facts are listed as the main advantages of investing in the fund instead of purchasing BTC directly (Exante.eu/press/news, 2013[a]):

- It is easier to purchase shares/investment units of the fund than bitcoins.
- Assets invested in funds instead of in direct purchase of bitcoins are considered safer, given that such funds, including Exante, place huge importance on cryptographic security of their clients’ assets.

Starting from June 2013 this fund has been offering to its clients the Automatic Trading Platform (ATP), i.e. an electronic trading platform enabling them a series of services, among other things, related to various statistical tools and portfolio management (Exante.eu/press/news, 2013[b]).

However, this fund is not the first financial institution operating with the BTC currency. Namely, one should also bear in mind the

Kao što se može zaključiti, iako je bitkojn po svojoj prirodi decentralizovana valuta koja čak i eliminiše potrebu za finansijskim posrednicima, same potrebe njegovih korisnika očigledno nameću potrebu za odgovarajućim finansijskim institucijama koje bi imale različite funkcije u bitkojn transakcijama. Kao neke od finansijskih institucija koje za sada posluju sa bitkojn valutom za sada su se izdvojile berze koje omogućuju razmenu najpoznatijih svetskih valuta za bitkojn i obratno. Takođe, sve češće se javljaju i druge finansijske institucije kao posrednici u plaćanju bitkojnima, a koje svojim klijentima nude veći stepen zaštite podataka i sigurnosti pri obavljanju transakcija u odnosu na direktna plaćanja bez korišćenja usluga finansijskih posrednika. U tom smislu, ukoliko izvršimo komparaciju razvoja decentralizovane bitkojn valute sa razvojem klasičnog novca, pojava nekog oblika centralnog entiteta u ovom sistemu (po osnovu ekonomske moći ili po osnovu nekih zakonskih odredbi) koji bi preuzeo neke od funkcija klasične centralne banke više ne deluje kao naučna fantastika. Naime, prvi oblici novca su, kao što je poznato, bili stoka, koža, so, med, krzno, kasnije metali kao što su gvožđe, bakar i plemeniti metali (srebro i zlato), a zatim i novčanice. Paralelno sa razvojem sredstava plaćanja javljali su se novi učesnici u privrednom životu kao što su zlatari koji su izdavali certifikate po osnovu deponovanog novca i međusobno vršili kliring potraživanja svojih klijenata. Nakon toga nastaju i privilegovane banke koje su bile jedine ovlašćene od strane države da emituju banknote, da bi prve centralne banke nastale tek u 17. veku (Đurović-Todorović 2010, str.18-23). U tom smislu, iako prve oblike novca nije emitovala nijedna centralna institucija, već sami ljudi, nije isključena mogućnost da nekada u budućnosti kriptovalute kao što je bitkojn, koje su po svojoj prirodi decentralizovane, dobiju centralnu instituciju. Međutim, budući da, prema mnogim shvatanjima, upravo decentralizovanost ovakve valute predstavlja faktor koji u najvećoj meri pozitivno utiče na tražnju za takvom valutom, postoji verovatnoća da bi u slučaju pojave centralnog entiteta u takvim sistemima opala tražnja za tim valutama, a povećala se tražnja za drugim valutama koje još uvek nisu centralizovane. U

konačnom, *ceteris paribus*, pokušaj regulacije i centralizacije neke kriptovalute bi u konačnom samo mogao dovesti do napuštanja tih valuta, erozije njihovog značaja i migracije korisnika i tranfera njihovih sredstava u druge valute.

Problemi funkcionisanja i regulacija bitkojna

Bitkojn valuta je gotovo u potpunosti van regulacionog spektra centralne banke i poreskih organa. Stoga je pojedini autori pogodnim instrumentom za stvaranje "crnog tržišta" različitih roba i usluga, a najznačajnija opasnost postoji ukoliko bi se koristila za obavljanje nelegalnih aktivnosti. Primera radi, zabeleženi su slučajevi kada se bitkojn valuta koristila za kupovinu droge putem Interneta (Manchin. senate.gov 2011).

Takođe, ništa beznačajniji nisu problemi po osnovu krađe (koje su se već dešavale) ili potencijalnog nekontrolisanog umnožavanja ove valute od strane cyber-kriminalaca (što je za sada praktično neizvodljivo). Usled toga, može doći i do značajnih fluktuacija kursa bitkojn valute. Između ostalog, postoje i procene stručnjaka za kriptografiju i sigurnost podataka na Internetu da se sigurnost ove valute može oceniti kao veoma niska (Economist.com 2012). Primera radi, 2011. godine se pojavio kompjuterski virus, tj. „Trojanac“ koji „krade bitkojn novčanike“ (engl. „Bitcoin wallet“), tj. koji, ukoliko se nađe na računaru onog ko koristi bitkojn valutu, preuzima i šalje putem Interneta na odgovarajuću adresu kompjuterske fajlove pomoću kojih je moguće sa nekog drugog računara koristiti tuđ bitkojn novac (Symantec.com 2011). Usled tog sigurnosnog kolapsa, vrednost bitkojna je pala sa 30,99 USD 08.06.2011. na svega 0,10 USD 20.06.2011. Do decembra 2011. godine vrednost valute se vratila na nešto više od 3 USD (ECB 2012, p.38). Sledeći značajan udarac na bitkojn valutu dogodio se 10. aprila 2013. godine. Tog dana je trgovina BTC valutom otpočela po ceni od 200 USD, da bi tokom dana dostigla svoj istorijski maksimum od čak 266 USD, da bi u roku od par sati njena vrednost pala ispod 100 USD. Iako su se prve sumnje odnosile na tzv. DDoS napad, zvaničnici MtGox berze su izjavili da je uzrok ovog problema preveliki obim trgovine.

“Bitcoin Savings and Trust” (“BTCST”) company which, using a classic Ponzi scheme, in the period from 2011 to September 2012 collected about 700,000 BTC (worth over 4.5 million USD) from its clients, having promised them weekly rates of return of as much as 7%, after which it embezzled all that money. On these grounds, in July 2013 the US Securities and Exchange Commission - SEC sued this company and its founder, Trendon Shavers (Wang, 2013).

Furthermore, there have been some announcements that owners of BTC will be able to withdraw official money issued by the central bank, on real ATMs, in equivalent amounts (perhaps reduced by a certain fee), and that bitcoins will be used on the POS terminals when purchasing in stores (News scientist.com, 2012).

As can be concluded, although bitcoin is in its nature a decentralized currency eliminating the need for financial intermediaries, the needs of its users obviously impose the need for appropriate financial institutions that would perform different functions in bitcoin transactions. For the time being, stock exchanges have singled out as a type of financial institutions currently operating with bitcoins, enabling the exchange of major global currencies for bitcoins and vice versa. Other financial institutions as well have been increasingly occupying the role of intermediaries in bitcoin payments, offering their clients higher data protection and security when conducting transactions, compared to direct payments without using the services of financial intermediaries. In this respect, if we compare the development of the decentralized bitcoin currency with the development of classic money, the occurrence of some form of a central entity in this system (based on economic power or certain legislative provisions), which would take over some functions of a classic central bank, no longer seems like science fiction. Namely, the first forms of money, as we all know, were cattle, leather, salt, honey, fur, later on metals like iron, copper and precious metals (silver and gold), and then banknotes. In parallel with the development of payment instruments, new participants entered the economic life, including goldsmiths, which issued certificates in respect of the deposited money, and performed mutual clearing and settlement of receivables from their clients.

The privileged banks were formed afterwards, as the only institutions authorized by the state to issue banknotes, whereas the first central banks were not to appear until the 17th century (Djurovic-Todorovic, 2010, pp. 18-23). In this sense, although the first forms of money were not issued by any central institution, but by people themselves, we should not eliminate the possibility of cryptocurrencies like bitcoin, which are decentralized in their nature, getting a central institution some time in the future. Nevertheless, bearing in mind that, according to many opinions, decentralization of such currency serves as exactly the factor which, to the largest extent, positively influences the demand for such currency, it is somewhat probable that, in case of a central entity entering the system, the demand for such currencies would diminish, and the demand for other, not yet centralized currencies, would increase. Ultimately, *ceteris paribus*, an attempt to regulate and centralize a cryptocurrency could only result in the abandonment of such currencies, erosion of their importance, migration of users and conversion of their funds into other currencies.

Functional Problems and Regulation of Bitcoins

The bitcoin currency is almost completely outside the regulatory scope of central bank and fiscal authorities. This is why certain authors consider it a suitable instrument for creating the “black market” of different goods and services, the major threat being its potential usage for conducting illegal activities. For instance, certain cases have been recorded when bitcoins were used to purchase drugs on the Internet (Manchin.senate.gov, 2011).

Equally significant are the problems concerning theft (the cases of which have already been recorded) or potential uncontrollable multiplication of this currency by cyber-criminals (which is, for now, practically unfeasible). This can, in turn, result in substantial fluctuations of the bitcoin FX rate. Among other things, there have been assessments by experts in cryptography and Internet data security, claiming that the security of this currency can be deemed extremely low

Inače, DDoS napad (engl. „distributed denial-of-service attack“) predstavlja napad na tržišni centar putem masovnog ispostavljanja naloga za trgovinu kako bi se izazvala blokada u trgovini i izvršio uticaj na cenu. Međutim, pravi DDoS napad je ubrzo zaista usledio, pa je berza prekinula proces trgovanja u periodu od 2 sata, mada je i narednih 8 sati postojao problem u pristupu mreži. Prekid trgovanja se desio na još nekim bitkojn berzama. Ovaj kolaps je ukazao na neke od osnovnih slabosti bitkojn valute, a koje se odnose kako na dominantan položaj MtGox berze, tako i na činjenicu da je veliki broj elektronskih berzi za trgovanje bitkojn valutom razvijan od strane web developer-a koji jesu iskusni profesionalci, ali nisu poznavali u dovoljnoj meri način funkcionisanja finansijskih berzi (Bitcoinmagazine.com 2013).

Jedno od osnovnih pitanja koje se postavlja od same pojave bitkojn valute odnosi se na legalnost njegove primene. Inače, kao razlozi zbog kojih bi bitkojn trebalo smatrati potpuno legalnom valutom navode se: pravo na slobodnu razmenu, činjenica da bitkojn ne predstavlja alternativu američkom dolaru kao zvaničnoj valuti, odnosno ni na koji način ne predstavljaju njegov falsifikat, niti se nalaze u širokoj upotrebi. Sa druge strane, kao razlozi zbog kojih bi trebalo zakonski preciznije regulisati korišćenje bitkojna navode se povećana mogućnost poreske evazije i činjenica da bitkojn otvara mogućnost za kreiranje poreskih rajeva i crnog tržišta različite robe (pre svega droge), kao i za pranje novca.

Naime, transakcije u bitkojnima prema

nekim ocenama imaju klasične elemente bartera, odnosno trampe, a takve transakcije su oporezive. Međutim, bitkojn po svojoj prirodi nudi anonimnost i mogućnost prikrivanja brojnih transakcija od poreskih organa čime se izbegava izvršenje poreske obaveze. Takođe, značajno pitanje se odnosi i na nadležno zakonodavstvo u slučaju transakcija u bitkojn valuti na međunarodnom nivou, kada bi bilo veoma teško utvrditi nadležnu poresku vlast. Sa jedne strane, kriptovalute (među kojima je trenutno najaktuelniji bitkojn) su sve popularnije. Sa druge strane, finansijske institucije su pod sve većim pritiskom da dostavljaju potrebne informacije o svojim klijentima poreskim organima i sarađuju sa njima kako bi se sprečila poreska evazija. Iako je reč o potpuno nezavisnim procesima, činjenica je da oni u sve većoj meri konvergiraju (Marian 2013, p.38). U tom smislu, korišćenje kriptovaluta je po svojim efektima dosta slično poslovanju u ofšor zonama, budući da profit ostvaren u, primera radi, bitkojn valuti nije predmet oporezivanja, a takođe korisnici ovih valuta imaju obezbeđenu anonimnost. Praktično, sa nastankom kriptovaluta poreski obveznici su dobili novo oružje za poresku evaziju. Štaviše, ne postoji ni institucija od koje bi poreski organi mogli da zahtevaju dostavljanje informacija o vlasnicima računa u toj valuti. U sistemima plaćanja zasnovanim na kriptovalutama ne postoje ni centralne banke kao emitenti, ni klasične finansijske institucije koje bi mogle biti predmet različitih pritisaka poreskih organa. Drugim rečima, korišćenje kriptovaluta za sada, uslovno rečeno, poreske vlasti ne mogu uspešno da kontrolišu, odnosno da detektuju korišćenje ovih valuta na sistematičan način, osim eventualno u pojedinačnim slučajevima. Prema nekim shvatanjima, postoji opasnost da će se u budućnosti poreska evazija sve više odvijati putem korišćenja kriptovaluta, a na štetu sadašnjih ofšor zona, odnosno mogu im predstavljati direktnu konkurenciju. Međutim, sa druge strane treba imati u vidu relativno malu vrednost virtuelne ekonomije u okviru koje se koriste te virtuelne valute, tako da je za sada prisutno i relativno malo interesovanje nadležnih poreskih organa za većom kontrolom ovih tokova. Takođe, trenutni ekonomski potencijal kriptovaluta im ne omogućuje da postanu značajnija konkurencija ofšor zonama.

(Economist.com, 2012). For instance, in 2011 a computer virus appeared, the so-called "Trojan", stealing bitcoin wallets - if this virus enters a computer of a person using bitcoins, it downloads the relevant computer files, sending them via the Internet to the designated address, enabling access to other people's bitcoins from a different computer (Symantec.com, 2011). Due to this security collapse, the value of bitcoins dropped from 30.99 USD as of 08.06.2011 to just 0.10 USD as of 20.06.2011. By December 2011 the currency value was restored to slightly over 3 USD (ECB, 2012, p. 38). The next substantial blow at the bitcoin currency occurred on 10 April 2013. On that day the trading in BTC started at the price of 200 USD, during the day reached its unprecedented maximum of 266 USD, only to drop below 100 USD within several hours. Although the first suspicions concerned the so-called distributed denial-of-service DDoS attack, the officials at the MtGox stock exchange stated that the cause of this problem was excessive trading volume. A DDoS attack is an attack at a trading centre by means of mass delivery of trading orders, aimed at causing blocked trading, and thereby impacting the prices. However, a true DDoS attack actually ensued soon after, causing the stock exchange to stop its trading process for 2 hours, with problems in network access manifesting themselves in the subsequent 8 hours. Breaches in trading occurred in some other bitcoin exchanges as well. This collapse pinpointed some of the main weaknesses of the bitcoin currency, referring both to the dominant position of MtGox stock exchange, and to the fact that a large number of electronic stock exchanges for BTC trading were developed by web developers who, though experienced professionals, were not sufficiently familiar with the way financial stock exchanges function (Bicoimazine.com, 2013).

One of the main issues raised since the very origination of bitcoins concerns the legality of their usage. The reasons why bitcoins should be considered a completely legal currency are as follows: the right to free exchange; the fact that bitcoin does not stand as an alternative to the US dollar as the official currency, i.e. in no way represents its counterfeit, nor is it widely used. On the other hand, the reasons why the usage

of bitcoins should be legally regulated in a more precise manner are: the increased possibility of tax evasion and the fact that bitcoins open the possibility to create tax havens and black markets for various goods (primarily drugs), and to launder money.

Namely, according to some assessments, transactions in bitcoins exhibit the classic elements of barter trading, and such transactions are non-taxable. Nonetheless, the nature of bitcoins offers anonymity and the possibility to hide numerous transactions from fiscal authorities, which leads to evading one's fiscal obligations. Another significant issue is related to competent legislation in case of bitcoin transactions at the international level, when it would be extremely difficult to determine the competent fiscal authorities. On one hand, cryptocurrencies (the most important of which at the moment is bitcoin) have been growing increasingly popular. On the other hand, financial institutions have been placed under ever more pressure to submit all the necessary information about their clients to tax authorities, and to cooperate with them in order to prevent tax evasion. Even though these two are completely independent processes, the fact is that they have been increasingly converging (Marian, 2013, p. 38). In this sense, using cryptocurrencies is, in its effects, much like off-shore operations, given that profit achieved, say, in bitcoins is not taxable, and the users of these currencies also have their anonymity guaranteed. Practically, the appearance of cryptocurrencies granted tax payers a new tool for tax evasion. Moreover, there are no institutions from which tax authorities could request the submission of information on clients holding accounts in that currency. In payment systems based on cryptocurrencies there are no central banks as issuers, or classic financial institutions that could be subject to various pressures of tax authorities. In other words, for now, conditionally speaking, tax authorities cannot successfully control the usage of cryptocurrencies, i.e. they cannot detect the usage of these currencies in a systematic manner, except perhaps in individual cases. According to some opinions, there is a danger of tax evasion developing in the future by resorting to cryptocurrencies, at the expense of

Pored poreske evazije, anonimnost koja je imanentna bitkojn valuti pruža i niz mogućnosti za prikrivanje različitih kriminalnih aktivnosti. Pod tim pre svega imamo u vidu trgovinu drogom, pranje novca, i niz drugih kriminalnih aktivnosti.

Stoga, kao potencijalna rešenja za rizike koje primena ove valute sa sobom nosi mogu se izdvojiti sledeći predlozi (www-cs-faculty.stanford.edu n.d.[2]):

- Forsirano licenciranje - Budući da u slučaju bitkojna ne postoji centralni entitet niti klasične finansijske institucije koje bi mogle biti primorane da izvrše registraciju kao posrednici u plaćanju (engl. „money transmitters“), postoje predlozi da bi se registracija trebala odnositi samo na vlasnike „mining“ računara. Međutim, to bi predstavljalo isuviše komplikovanu proceduru, a takođe bi postojao problem vezan za regulaciju ukoliko bi se „rudarenje“ vršilo iz drugih zemalja u kojima ne postoji ovakav oblik regulacije.
- Zahtevi za poreskim izveštajima - Postoji ideja da bi svi korisnici bitkojna trebalo da automatski budu u obavezi da poreskim organima dostavljaju sve izveštaje o transakcijama u ovoj valuti. Međutim, primenom ovakve mere poreski organi bi se suočili sa preprekama kao što su: mogućnost obavljanja transakcija iz inostranstva, teška izvodljivost s obzirom na neophodnost saglasnosti korisnika, nestabilna vrednost bitkojn valute i niz drugih.
- Prinudno gašenje - Kao jedan od načina za gašenje ove i sličnih valuta može se navesti i formalna zabrana korišćenja ovakvih valuta kao sredstava plaćanja i donošenje niza restriktivnih zakonskih odredbi kojima bi se suzbijalo ili kontrolisalo korišćenje ovih valuta. Takođe, postoje ideje da bi virtuelne valute, s obzirom na relativno mali ekonomski značaj, mogle da budu u potpunosti otkupljene od strane centralne

banke ili da centralna banka angažuje resurse koje bi koristila za „rudarenje“ tih valuta, čime bi one bile eliminisane iz dalje upotrebe (Marian 2013, p.47). Međutim, to bi uvek iziskivalo manje ili veće troškove. Takođe, tu bi se možda pojavila i mogućnost različitih zloupotreba.

Međutim, i pored izdvojenih teorijskih shvatanja o nužnosti i načinu regulacije transakcija u bitkojn valuti, zanemarljivo mali broj zemalja je učinio nešto konkretno po tom pitanju. Primera radi, u slučaju SAD-a ne postoji nijedna zakonska odredba kojom se izričito zaključuje zabrana korišćenja ove valute i definiše njeno korišćenje ilegalnom aktivnošću (www-cs-faculty.stanford.edu n.d.[1]). Sa

druge strane, postoje i određeni pokušaji da se različitim preporukama, direktivama i podzakonskim aktima daju smernice za regulaciju alternativnih valuta, uključujući i decentralizovane virtuelne valute kao što je bitkojn. Jedan od njih je i „Primena FinCEN-ove regulacije na osobe koje administriraju, razmenjuju i koriste virtuelne valute“ (engl. „Application of FinCEN’s Regulations to Persons Administering, Exchanging, or Using Virtual Currencies“). U pitanju je preporuka kojom je „Financial Crimes Enforcement Network“ kao departman Trezora SAD-a pokušao da da sugeriše način implementacije „Bank Secrecy Act“ regulative na virtuelne valute. Prema ovoj preporuci, ekonomski subjekt koji kreira virtuelnu valutu i koristi je za kupovinu realnih dobara i usluga se smatra korisnikom te valute i njegove aktivnosti nisu predmet regulacije. Sa druge strane, subjekt koji kreira virtuelnu valutu i prodaje je za zvanično sredstvo plaćanja se smatra posrednikom u plaćanju i njihove aktivnosti su predmet regulacije (Fincen.gov 2013, p.5). Međutim, osim ovog pojmovnog razgraničenja ovom preporukom nije dat odgovor na niz dodatnih pitanja vezanih za regulaciju ovih transakcija.

U Nemačkoj je ove godine bitkojn dobio status „privatnog novca“ (engl. „private

today's offshore areas, these two being direct competitors. However, one should bear in mind a relatively low value of virtual economy within which the concerned virtual currencies are being used, which is why, for now, it is accompanied by a relatively low interest on the part of competent tax authorities for introducing wider control of these flows. Also, the current economic potential of cryptocurrencies does not enable them to become a considerable competitor to offshore areas. In addition to tax evasion, the immanent anonymity of BTC provides a series of possibilities for covering up various criminal activities. This primarily refers to drugs trafficking, money laundering, and various other criminal offences.

Therefore, the following proposals can be singled out as potential solutions for risks entailed by this currency's usage (www-cs-faculty.stanford.edu, n.d.,[2]):

- Enforce licensing - Given that in case of bitcoins there are no central entities or classic financial institutions that could be forced to register as money transmitters, some proposals have been put forward for the registration process to involve only the owners of the mining computers. However, this would be too complicated a procedure, and it would also incur the problem concerning regulation, if the mining process were performed from other countries with no regulation in this respect.
- Demand tax reports - There is an idea for all users of bitcoins to be automatically obliged to submit to tax authorities all the reports on transactions in this currency. However, by implementing this measure tax authorities would face the following obstacles: possibility of cross-border transactions, low feasibility given the necessary compliance on the part of users, unstable value of bitcoins, etc.
- Forced shut-down - One of the ways to shut down this and similar currencies could be

the formal ban to use such currencies as a means of payment, accompanied by a series of restrictive legal provisions suppressing or controlling the usage of these currencies. Besides, there have been ideas that virtual currencies, given their relatively low economic significance, could be fully acquired by the central bank, or that the central bank could engage resources to "mine" these currencies, which would eliminate them from further usage (Marian, 2013, p. 47). However, that would always entail lower or higher costs. Also, that would perhaps generate the potential for all kinds of abuses.

Nonetheless, despite the prominent theoretical positions on the necessity and ways of regulating BTC transactions, hardly any countries have actually undertaken concrete measures in this respect. For example, in the USA there is not a single legal provision explicitly banning the usage of this currency and defining its usage as illegal activity (www-cs-faculty.stanford.edu, n.d.,[1]). On the other hand, there have been certain attempts to provide guidelines, in the form of various recommendations, directives and by-laws, for the regulation of alternative currencies, including the decentralized virtual currencies like the bitcoin. One of them was the "Application of FinCEN's Regulations to Persons Administering, Exchanging, or Using Virtual Currencies".

It is a recommendation whereby the Financial Crimes Enforcement Network, as a US Treasury Department, tried to suggest how to implement the "Bank Secrecy Act" when it comes to virtual currencies. According to this recommendation, an economic entity creating a virtual currency and using it to purchase real goods and services is considered the user of that currency, and his activities are not subject to regulation. On the other

hand, an entity creating a virtual currency and selling it as an official means of payment is considered a money transmitter, his activities undergoing regulation (Fincen.gov, 2013, p. 5). Yet, besides this differentiation in terminology,

money“), čime je načinjen značajan korak napred ka širem zakonskom obuhvatu i masovnijem korišćenju ove valute. Korišćenje bitkojna i njegova emisija nisu zabranjeni, međutim, profit po osnovu korišćenja bitkojna podleže poreskim zakonima. Naime, prihodi ostvareni po osnovu prodaje proizvoda i pružanja usluga ostvareni u bitkojn valuti se oporezuju porezom na dodatu vrednost, dok se sav ostali profit po osnovu emisije ili korišćenja bitkojna oporezuje porezom na dohodak, odnosno dobit (Dw.de 2013). Međutim, nije naglašeno na koji bi način bilo rešeno pitanje poreske evazije.

Iako po pitanju regulacije bitkojna nije mnogo učinjeno ni u Francuskoj, značajno je zapaziti činjenicu da su regulatorni organi Bitcoin-Central-i, jednoj od bitkojn berzi, dali dozvolu za obavljanje određenih bankarskih poslova, pre svega onih vezanih za usluge platnog prometa. Time će njenim klijentima biti omogućeno da deponuju sredstva u evrima ili bitkojnima i da ih jednostavno konvertuju (Tagteam.harvard.edu n.d.). Takođe, ova sredstva su deponovana na računu druge finansijske institucije, i u skladu sa tim su osigurana do iznosa od 100.000 EUR od strane francuskog „Fonda za garanciju depozita“ (franc. „Fonds de garantie des dépôts“) (En. bitcoin.it n.d.).

Međutim, i pored ovih pojedinačnih izuzetaka, u opštem slučaju područje alternativnih valuta, a pre svega decentralizovanih kriptovaluta kao što je bitkojn do sada nije adekvatno, nedvosmisleno i u potpunosti regulisano ni u jednoj od relevantnih jurisdikcija.

Zaključak

Bitkojn predstavlja specifičnu valutu koja se po svojim karakteristikama razlikuje od svih svojih prethodnika. Otkad se pojavila pokrenula je niz kontroverzi vezanih za pozitivne i negativne efekte njene primene. Emisija ove valute je kompjuterski programirana i ograničena, zasnovana na „peer-to-peer“ tehnologiji i tehnologiji enkripcije podataka čime se faktički eliminiše mogućnost dvostrukog plaćanja, falsifikovanja

i sličnih zloupotreba. To je ujedno i jedan od glavnih razloga zbog čega se ova valuta smatra sigurnom iako ne postoji centralna emisiona institucija. Transakcioni troškovi su veoma niski, gotovo su zanemarljivi, ali same transakcije nisu reverzibilne, što se može oceniti značajnim nedostatkom ove valute.

Međutim, s obzirom na činjenicu da je makroekonomski značaj bitkojna zanemarljivo mali, čak i manji šokovi mogu negativno uticati na njegovu stabilnost i izazvati drastične fluktuacije deviznog kursa. Pritom ne postoji centralna institucija koja bi mogla svojim merama pozitivno da utiče na njegovu stabilizaciju, a što može predstavljati značajnu prepreku za masovnije korišćenje ove valute. Budući da ova valuta svojim korisnicima praktično pruža potpunu anonimnost i netransparentnost njihovih aktivnosti, postoje kritike da se na taj način kreira pogodan ambijent za pranje novca, kreiranje crnih tržišta nelegalne robe, poresku evaziju i niz drugih kriminalnih radnji. Takođe, postojali su slučajevi različitih zloupotreba poput Ponzijevih šema i kompjuterskih Trojanaca koji su korišćeni za krađu elektronskih novčanika korisnika bitkojn valuta.

Stoga se vodi sve češća diskusija o potrebi regulisanja ovakvih kriptovaluta. Iako je određen broj zemalja počeo da reguliše bitkojn transakcije, i dalje je relativno malo učinjeno po tom pitanju budući da ovakvo pitanje zahteva veliku opreznost. Naime, bilo koji oblik kontrole i regulacije ovakvih valuta bi za posledicu mogao imati preusmeravanje korisnika tih valuta na korišćenje drugih kriptovaluta koje još uvek nisu predmet regulative ili transfer bitkojn transakcija u one jurisdikcije u kojima one nisu regulisane. U tom smislu, jedan od najvećih izazova za centralne banke i nacionalne regulatorne organe u budućem periodu će se vrlo verovatno odnositi na praćenje efekata korišćenja ovakvih valuta i njihovu regulaciju, odnosno preduzimanje adekvatnih mera u slučaju različitih zloupotreba ili izazivanja nestabilnosti. Kakva će biti budućnost bitkojna i sličnih kriptovaluta zavisice kako od regulacije ovakvih valuta, tako i od njihove sigurnosti i stabilnosti.

the concerned recommendation does not provide the answer to a series of additional questions concerning the regulation of these transactions.

This year in Germany bitcoins were granted the status of “private money”, which marked a significant step forward, towards a wider regulatory scope and mass usage of this currency. The usage of bitcoins and their issuance are not prohibited, but the profit in respect of using bitcoins undergoes fiscal laws. Namely, the revenues from selling products and providing services achieved in bitcoins incur value added tax, whereas the remaining profit in respect of issuing or using bitcoins incurs income, i.e. profit tax (Dw.de, 2013). Nevertheless, there is no mention of how to address the issue of tax evasion.

Even though France has not done much to regulate the issues of bitcoins either, it is worth noticing the fact that the regulatory bodies of Bitcoin Central, one of the bitcoin exchanges, gave their permission for conducting certain banking operations, mostly those related to payment system services. This would enable its clients to deposit their funds in euros or bitcoins, or to simply convert them (Tagteam.harvard.edu, n.d.). Also, these funds are deposited at the account of another financial institution, and in line with this, they are insured up to the amount of 100,000 EUR by the French *Fonds de garantie des dépôts* (En.bitcoin.it, n.d.).

However, despite these individual exceptions, generally speaking, the field of alternative currencies, first and foremost decentralized cryptocurrencies such as the bitcoin, has not yet been adequately, unambiguously and completely regulated in any of the relevant jurisdictions.

Conclusion

Bitcoin is a specific currency whose characteristics set it apart from all of its predecessors. Since it first appeared, it launched an avalanche of controversies related to both positive and negative effects of its implementation. The issuance of this currency is computer-programmed and limited, based on peer-to-peer technology and data encryption technology, which practically eliminates the possibility of

double-spending, counterfeiting and similar abuses. At the same time, this is one of the main reasons why this currency is considered safe, even though there is no central issuing institution. Transaction costs are very low, almost negligible, but the transactions themselves are non-reversible, which may be deemed a significant shortcoming of this currency.

Nevertheless, given the fact that the macroeconomic significance of bitcoins is trifling, even the slight shocks may adversely impact its stability and cause drastic fluctuations of its FX rate. All the while, there is no central institution whose measures could facilitate its stabilization, which may be a huge obstacle standing in the way of the mass usage of this currency. Bearing in mind that this currency practically provides to its users full anonymity and non-transparency of their activities, some criticism has been voiced, stating that this generates suitable environment for money laundering, black markets of illegal goods, tax evasion and many other criminal offenses. Moreover, there have been recorded cases of various abuses like Ponzi schemes and computer Trojans, used to steal e-wallets from bitcoin users.

This has resulted in frequent debates on the necessity of regulating such cryptocurrencies. Although some countries have started to regulate bitcoin transactions, not much has been done in this respect given that this issue requires an extremely cautious approach. Namely, any form of control and regulation of such currencies could consequently cause a redirection of these currencies' users to other cryptocurrencies that still have not undergone regulation, or a transfer of bitcoin transactions into those jurisdictions in which there is yet no regulation in this field. Therefore, one of the biggest challenges for central banks and national regulatory bodies in the forthcoming period will most likely be related to monitoring the effects of these currencies' usage and their regulation, and to undertaking adequate measures in case of various abuses or instabilities. The future of bitcoins and similar cryptocurrencies will depend both on the regulation of such currencies, and on how secure and stable they are.

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