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AN ANALYSIS OF BITCOIN

Abstract:

In spite of the fact that a lot of virtual currencies have been created in recent years, bitcoin is the best known from all of them and regularly reported in the news. Currency without identified creator is appreciated by its user for non-centralized running, without any chance of governments to influence the money supply. The advantages of bitcoin, such as very quick payments worldwide, stop of inflations caused by governments trying to solve their own problems or high level of transactions privacy are widely mentioned.
The aim of the article is not to describe the technical issue of bitcoin and explain how this system works, because it has been widely explained in other articles. The aim is focusing on economic aspects of bitcoin, the technical aspects are mentioned only if necessary. For accomplishing the aim the article is split in three parts.
The first part is dedicated to answering the question “What is bitcoin?”. It examines whether bitcoin complies with theoretical, empirical and law definition of money. The law definition of money compliance is done for Czech, German and EU law in general, but attitudes of US and Chinese governments are also mentioned. According to the findings, bitcoin cannot be easily considered as money.
The second part is focused on monetary aspects of bitcoin. It analyses the question, “What would mean for an economy to accept bitcoin as legal tender?”. In the case of single economy the money supply would be completely out of control of government and due to easy way of bitcoin transferring, money supply could be increased and decreased quickly. In the case of global economy, deflation and its impacts would be inevitable.
The third part concentrates on bitcoin banking. No possibility of bitcoin lending does not mean the end of banking industry, but would probably lead to a significant change in how it works.

Keywords:

Bitcoin; definition of money; money supply, banking

JEL Classification: E41, E42

1. Introduction

The virtual currency Bitcoin is one of the striking phenomena of recent years. I have participated in several conferences and meetings focusing exclusively on Bitcoin and listened to the opinions of the participants. Most of these views consider Bitcoin as positive, almost in an exalting way. Bitcoin should represent a decentralized new currency that is beyond the control of any government. The government can no longer manipulate inflationary with savings of citizens and citizens become freer. Due to the anonymity of transactions, tax collection is impossible. The only possibility of funding the state should be crowdfunding, when the people themselves will decide what government project they support. States together will no longer be able to fight in wars, because by disabling of “money printing" they will no longer have the resources to finance wars. Bitcoin is a revolution in remittances, remittances could not be simpler. Bitcoin beats not only companies collecting exorbitant fees for sending money, but seriously threatens the financial intermediation as we know it. Since it is no longer possible to simply create money, it will also make impossible future financial crisis.

I could go on in creating the list of concepts related to Bitcoin. Nevertheless I realized that most of the participants in such meetings are not economists, but computer scientists and technological enthusiasts. It gave me a definite answer to the question why there is so little space devoted to the monetary aspects of Bitcoin. In principle, this fact could be explained from two perspectives: Economists either totally missed the onset of revolutionary news on financial markets, or they considered the whole thing as so minor and unrealistic, that they do not feel the need to express their opinions at all. As the time passes, Bitcoin attracts more attention of economists and this article is part of that.

In the following text, I do not intend to deal with technical aspects of Bitcoin and explain, how exactly Bitcoin works. It is really a question more for IT scientists. I want to focus on what Bitcoin is and its monetary aspects and contribute to answering the question whether there can be an economy based on Bitcoin as its currency or not.

2. What is Bitcoin?

The question in the headline may seem naive at first glance and the answer is (seemingly) trivial. Bitcoin is usually referred as cryptocurrency, i.e. currency that is encrypted, sometimes as a virtual currency, or more precisely as money and it is in this way that it is perceived by its users and supporters. The first definition, which can be found on portal dedicated to Bitcoin, states "Bitcoin is an innovative payment network and a new kind of money" (bitcoin.org).

2.1. Bitcoin and theoretical definition of money

Answering the question in the form of a clear statement "bitcoin is money" is not entirely unproblematic. The theoretical definition of money considers money as "any asset that is generally accepted for payment for goods or services, or for debt settlement" (Revenda et alt., 2005, p. 20). In the case of Bitcoin we get inconsistent with the definition with the requirement of general acceptance. Although the rate of Bitcoin usage increases over time, we cannot talk about general acceptance. If we

want to argue in favor of Bitcoin, we would have to define the Bitcoin community of users who accept Bitcoin as money. None of us doubts that for example Indonesian Rupiah falls into the category of money, but it is clear that it would be very difficult to purchase something in the Czech Republic (and equally difficult it would be to convert IDR in CZK). Such argument, however, is largely misunderstood due to omission of definition distinction between "money" and "currency". National currency is a form of money (Revenda et alt., 2005, p. 28) and therefore we can talk about the general acceptance of the Indonesian Rupiah in Indonesia, the Czech koruna in Czech Republic, but the same cannot be said about Bitcoin, which is not legal tender in any country.

The way out of this definition trap in the form of a clear definition of the users' community seems to be impossible. The community is very open, the user may be virtually anyone who wants. The only common feature is just acceptance of Bitcoin. If we accepted such definition benevolence, virtually anything, what is accepted as a value of exchange by few individuals, could become money.

The second problematic area of Bitcoin in relation to the theoretical definition of money is the perception of money as an asset. If the money for the user is an asset, it is logically implied that the issuer constitutes a liability, obligation, which must be satisfied. Although this is a formal relationship today - in practice it is not possible to require an exchange of issued money for another asset by the central bank – this relationship is displayed in the central bank's balance sheet. Nothing like that is valid for Bitcoin. The new issue of money is (temporarily) the consideration for the service provided in the form of operation of the entire system and the receiver puts received Bitcoin to the side of its assets, with the missing central authority there is also a missing similar accounting record in the issuer balance sheet. New bitcoins are issued on established algorithms, from formal (accounting) point of view "from nothing".

2.2. Bitcoin and empirical definition of money

Contemporary monetary theories use, next to theoretical definition of money, empirical definition because the theoretical definition is limited to legal money too. The aim of the empirical definition of money is to deal with the relationship between quantitative development of money and other macroeconomic variables. Therefore, in addition to the definition of money, it copes with the question what money is and what is not in circulation. In order to monitor the development, monetary aggregates are constructed and they represent the sum of cash with a certain degree of liquidity (Revenda et alt., 2005, p. 24).

In the case of Bitcoin, the empirical definition is again in serious trouble. It is clear what is and what is not bitcoin. Given that, Bitcoin is not significantly associated with banking system, there is no such thing as Bitcoin term deposits or securities issued in Bitcoin. Bitcoin can be used at any time and therefore differentiation according to the levels of liquidity is meaningless. Bitcoin can be in terms of liquidity equated to money on current accounts in banks, more precisely with regard to speed of the bitcoins transfers we can talk about a "virtual cash". Bitcoin can therefore be clearly included in M1, but no other bitcoin monetary aggregates exist.

To determine what bitcoins are or are not in circulation is very problematic. Number of issued bitcoins at any given time is known, as is known the total number of bitcoins that will be issued. This does not mean that all existing bitcoins are in circulation. It is not even a matter of possible bitcoin savings, i.e. the amount of money that is not deliberately used (like a standard cash money at home in the mattress). The amount of bitcoin is actually reduced by losses. There could be a destruction of the entire data repository to relevant bitcoin account, or the access is lost. Publicly known is the case of a British man, James Howells, who threw his computer disk wallet containing 7,500 Bitcoin out and then searched for it at the local landfill (Novinky.cz, 2013). If you lose your password, the access to relevant wallet will be lost as well. Bitcoins stored on it are therefore de facto out of circulation. While cash money is renewed by the central authority and the access to the current account can be claimed (and money stored on it can be economically used by the bank), in the case of Bitcoin these rules cannot be applied. It cannot be said how much bitcoin are actually usable in the economy and could be stated that after the end of bitcoin emissions, the number of usable bitcoins is going to be decreased.

2.3. Bitcoin and law definition of money

The final definition approach to the money, I would like to mention, is the legal definition. Each country somehow defines legal tender and discussions about the legal status of Bitcoin and other virtual currencies take place both in developed economies (USA, EU, including the Czech Republic) and developing economies (China).

Czech legislation is an example of how bitcoin, by its users undoubtedly considered for money, does not meet criteria for legal category of money. The Czech Payment Services Act defines electronic money by following criteria:

Electronic money is monetary value that
a) represents a claim to the issuer,
b) is stored on an electronic means of payment,
c) is issued against receiving of funds in the value not less than the value of issued electronic money
d) is accepted as means of payment by persons other than the issuer.
(Payment Services Act, § 15, subsection 2)

Bitcoin does not meet criteria to be included in the category of electronic money. As mentioned above, bitcoin does not represent for issuer a liability in its balance sheet and therefore we cannot talk about bitcoins as a claim of the owner to the issuer. This problem is highlighted by the condition of issuing electronic money against receipt of funds. Such an exchange does not occur at all.

Perceiving bitcoin as electronic money is eliminated by the nature of the publisher. Only banks, foreign banks or their branches, domestic or foreign credit unions or foreign electronic money institutions, electronic money issuers of small extent or Czech Central Bank can issue electronic money (from legal point of view). The electronic money institutions are allowed to issue electronic money on the basis of the issuance of electronic money agreement (Schlossberger, 2012, p. 144). Bitcoin, a decentralized system without institutional operators cannot fulfill this condition.

What is Bitcoin according to the Czech law? Bitcoin does not meet criteria of any category of money and it is necessary to seek its inclusion among other categories. Bitcoin is not according to Czech law security, which is the second category that comes to mind intuitively, because Bitcoin is similarly traded on stock exchanges. There is not any right associated with Bitcoin that could be represented. There is also the question whether bitcoin is a commodity. It is not possible to connect Bitcoin with any type of consumption as it is common for other commodities. The only possibility is the use for other exchange. Bitcoin cannot be referred as a commodity at all.

The Czech law no. 89/2012 Coll. § 489 defines a thing as everything what is different from the person and serves to satisfy the needs of people. Because of bitcoin having no physical substance, it can be considered as an intangible thing as Czech law stated, which is storable on a tangible medium in electronic form. Another possible definition of Bitcoin according to the Czech law is the inclusion under fee stamps of special kind (fee stamps sui generis). Fee stamps are defined as means of payment replacing the money that is acquired by paying the amount equal to their nominal value. Determination of the nominal value of Bitcoin is again a problem. Bitcoin does not have, unlike for example tax stamp, nominal value given in Czech Crowns. From the point of view of common sense we could consider the transaction of bitcoin purchase as money exchange (buying one bitcoin for another bitcoin does not make sense, the direct value against any other currency is not determined, the price is a result of market supply and demand). Therefore bitcoin must be referred as fee stamp of special kind (Vrbíková, 2014, p. 138).

Legal directives and authority statements of relevant institutions keep a distance from Bitcoin. Czech Central Bank statement about Bitcoin explicitly states that trading with Bitcoin does not need permission of Central Bank and is not subject to its supervision. That would happen only in the case of derivatives trading on bitcoins, managing funds investing in bitcoins or the execution of payment transactions in connection with organization of trades with bitcoins, if there is a transfer of cashless money or electronic money between buyers and sellers[1]. However, the statement also includes some warning that systematic denial of domestic money as payment for goods and services already meets the definition of a criminal offense. Accepting Bitcoin as payment for goods and services, however, is not a problem.

Methodological guideline of the Financial-Analytical department of the Ministry of Finance about approach of liable persons to digital currencies is engaged in the use of digital currency risk as a tool through which track of transferred funds can be interrupted. The definition of bitcoin is not included and bitcoin is perceived more in terms of its function as a payment system. According to the guideline, any payment in excess of 1 000 EUR is perceived as "very risky" and as a suspicious transaction and each transaction with a value higher than EUR 15 000 must be reported (Financial-Analytical dept., 2013).

Recognition of Bitcoin as money in German law is a result of a misunderstanding of German legal specifics. Bitcoin is not recognized in Germany as legal tender or a foreign currency. Bitcoin only meets the criteria of “accounting unit”. “Accounting unit”

[1] This definition does not include transfer of money againts bitcoins.

is specific to German law comparable with foreign exchange but with the difference that it is not recognized as a legal means of payment. In this category, values, that serve as private means of payment, which are used in private contracts as means of payment for a specific group of users, are included. It can be therefore referred to bitcoins as "private money." Such classification is a compromise and probably best reflects the nature of use of Bitcoin. At the same time, however, this inclusion implies the need to pay sales tax when trading with Bitcoin (Deutscher Bundestag, 2013, p. 49).

Due to the reflection of European law into Czech law it is not surprising that bitcoin does not meet the definition criteria of electronic money according to European directive on electronic money (2009/110/EC) from the same reasons as in Czech law. Another relevant directive for bitcoin classification may be the Payment Services Directive (2007/64/EC). This directive is dependent on the definition of the electronic money directive and due to this reason the bitcoin gets again out of its definition range. Even on the European level, bitcoin remains outside the category of money and officially it is not categorized with unclear status (ECB, 2012, p. 43). The European Central Bank defines the virtual currency in its analysis as "*a kind of unregulated digital money, which is subscribed and usually controlled by their developers, and used and accepted by the specific virtual community*" (ECB, 2012, p. 13). However, this is not the official legal definition, but only conceptual clarification. In terms of the ECB definition bitcoin belongs into the category of virtual currency schemes with bidirectional flow. This reflects the fact that legal tender can be exchanged for bitcoin and vice versa, and can be used to purchase goods and services in the real economy (ECB, 2012, p. 14).

The result of the ongoing discussion on the categorization of bitcoin in USA is its designation as "property". As a result of this categorization, American property taxes must be paid. In the USA even mining of bitcoins is regulated, for which is Money Transmitting Licence required. Even in the USA bitcoin is not considered as money (Vrbíková, 2014, p. 137).

Clear statement to bitcoin could be found in Chinese law in the document called Notice on Precautions Against the Risks of Bitcoins issued in December 2013. Bitcoin is defined as "a virtual commodity" and its inclusion in the money category is explicitly excluded together with its use as money. Chinese banks and payment institutions are prohibited from trading with bitcoins. Bitcoins cannot be used for pricing products and services. Providing of any services directly or indirectly related to bitcoin is also excluded, and it is suggested to strengthen supervision of websites that provide services connected to Bitcoin (The Law Library of Congress, 2014, p. 6).

From the above mentioned it is clear that although bitcoins are intuitively considered as money and mostly it is about bitcoins referred in this way, it is not possible to clearly consider virtual currency as money. In terms of acceptance of bitcoins, the legal status is unclear, to be more precise it is not explicitly addressed. In the case when the legal status is explicitly addressed, bitcoins are excluded as money.

To conclude this section, I consider it appropriate to clarify terminological terms of use of bitcoin, BTC and Bitcoin, in which exists a quite large confusion among the authors

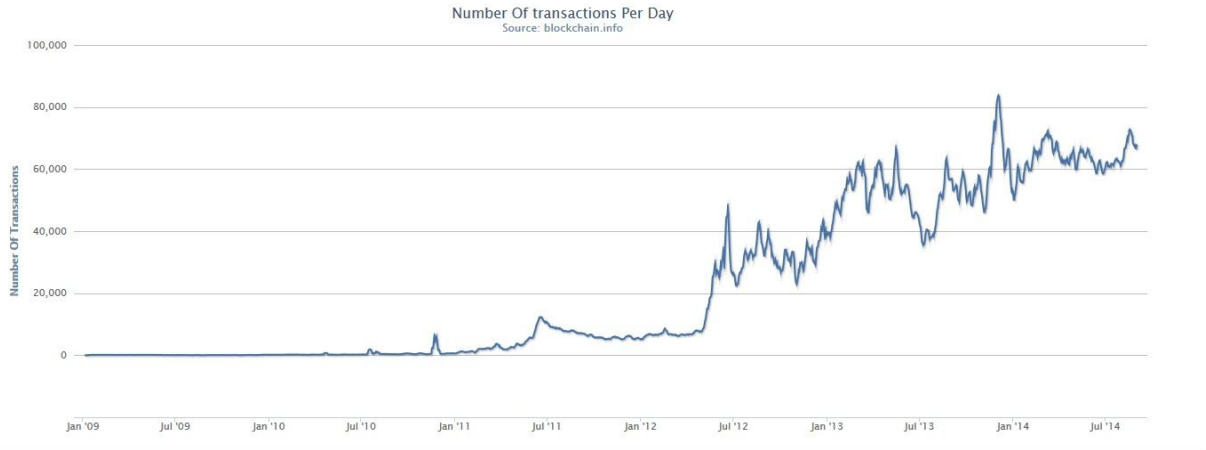
and which at the same time is closely related to understanding what bitcoin is. Bitcoin (capital B) refers to the whole protocol, software or community. For the purposes of this article Bitcoin may be considered as payment system. On the other hand, bitcoin refers to currency or units of currency. BTC is then generally used abbreviation to imitate the standard three letter abbreviations of different national currencies (eg. CZK, IDR, EUR) (Bitcoin, 2014).

3. Bitcoin and theory of money

Bitcoin is a new innovation in recent years, which was enabled by the development of modern technologies and increasing internet penetration in the world. Without this development, the existence and use of Bitcoin is not conceivable. In spite of this fact the idea of thus conceived money was already invented in the nominalistic conception of money from the ancient thinker Plato. Plato considers money only as a means of exchange, not for wealth itself, money is only a symbol established on an agreement. It should be noted that Plato's idea of circulation and purchasing power of money guaranteed by law and the state, does not correspond with the principles of Bitcoin (Koderová, 2011, p. 13). In the case of Bitcoin, both are provided by market forces and confidence of its users.

Let us discuss briefly the concept of trust. Although the concept of trust cannot be quantified and belongs to psychology, it is the basic foundation of the functioning of markets. The whole banking or financial system is built on trust. Run of clients is inevitable with the loss of confidence to the bank. Similarly, the legal value of money is based on confidence despite the laws that force money in circulation. The value of the dollar, the euro and the Czech crown is built by market forces in the foreign exchange markets. The question is why bitcoin is sought as an alternative means of payment. The graph below shows the number of Bitcoin transactions, which in 2014 has a rather stagnated trend. It is unquestionable that with the current number of transactions, 60-70 thousand within a day, Bitcoin is just marginal means of payments in the world (for comparison Visa processes about 2,000 transactions per second), but it is still a phenomenon that deserves attention.

Graph 1: Number of Bitcoin transaction per day

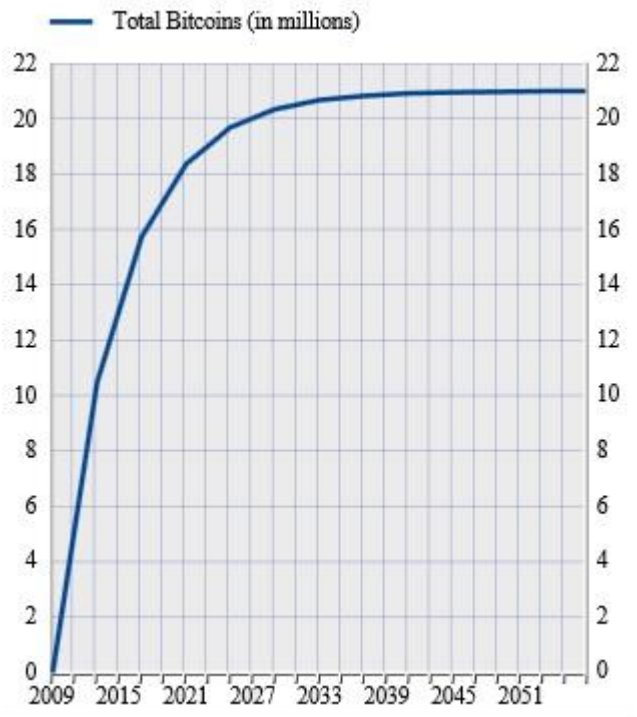


The reason for this the demand for an alternative is distrust in the existing legal tender. This may sound strange in an era of low inflation being the main objective of

central banks. The mistrust stems from the increase of central bank's balance sheets, which are trying, by pumping money into the economy, to support economic growth. Paradoxically, the central bank's effort to help the economy goes against a certain part of the population with preference of virtual currency. Specifically the risk of currency depreciation is mentioned and thus depreciation of the savings of the population, because legal money could be devaluated by additional printing, counterfeiting, increase of the money supply due to central bank decisions and the danger of control by indebted governments who might want to solve their problems by money handling (Taborsky, 2014, p. 102). The main advantage of Bitcoin (and bitcoin) is the absence of any need to trust him. "Bitcoin is so transparent and without any possibility to be ruled by any organization, that it sets its credibility itself".(Bitcoin.org).

What is by Bitcoin supporters considered as a great advantage in terms of credibility, is currently a serious disadvantage of this currency. Supply of bitcoins is determined in advance and the amount of bitcoins in economy cannot be affected. The growth of money supply is shown in the following chart.

Graph 2: Number of total bitcoins



Source: ECB, Virtual currency schemes

The final number of bitcoins is 21 million. However, already around the year 2020 about 90% of the final volume will be mined. At the time of writing this article approximately 13 million bitcoin is extracted, it means more than half of total volume. The size of the monetary base is thus temporarily increasing to be gradually slowed and comes to a complete stop. At this stage, there is in fact a decrease of number of bitcoins because of the above mentioned losses.

Such behavior of bitcoins supply is not a problem if we are talking about Bitcoin as a payment system. Because of the divisibility of bitcoins to eight decimal places it is not a problem to evaluate the cheap stuff at a high bitcoin rate to for example USD[2]. But if we apply a macroeconomic point of view, we must necessarily conclude deflationary character of bitcoin economy.

3.1. Possible inflation in Bitcoin economy

Let's imagine now the economy, whose representatives would in 2020 decide to accept bitcoins as legal tender. Now let´s analyze the relationship between the quantity of money in circulation and economic growth in the theoretical Bitcoin economy based on the equation of exchange. Equation of exchange can be formulated according to the formula 1.

Formula 1: Equation of exchange

$$M \times V = P \times Q_M$$

M is total nominal amount of money in circulation

V is velocity of money

P is price level

Q_M is real product expressed in money

If we replace in this formula the absolute values with pace of growth, we will get the formula in following expression:

Formula 2: Equation of exchange in pace of growth expression

$$\%M + \%V = \%P + \%Q_M$$

With the assumption that Bitcoin will be set as legal tender in 2020 it implies that the money supply is virtually unchanged, it means % M = 0. Let's assume for simplicity that even the velocity of money remains unchanged, it means % V = 0. The above mentioned equation implies that the growth rate of real output is the same as the rate of decline of the price level, it means % Q_M = - P%. If there is growth of real output then there is increase of the purchasing power of one bitcoin.

The result of this analysis is deflationary character of Bitcoin economy, which means for Bitcoin supporters a positive statement. There is, however, question whether Bitcoin keeps the deflationary character at all times. Tacit assumption of the analysis

[2] In fact, there will be 2 099 999 997 690 000 units called satoshi at disposal. 100 000 000 satoshi represents one bitcoin. Source: https://en.bitcoin.it/wiki/Bitcoin.

was a closed economy. Relationship between growth of real output and decline of the price level was based on the fact that at the beginning of the period in the economy there is, for example, 1000 bitcoins and 100 units of produced goods. For one piece of goods is in average 10 bitcoins. Assuming that the economy reached 3% growth, it would mean that in the end of the period there will be still available 1000 bitcoins for 103 produced goods. For one piece of goods there would be in average only 9.708738 bitcoins. Such developments, however, may not occur when we apply another characteristic of bitcoin, that it is out of control of any government. Out of government control is not only the issue of money, but also its transfers from one economy to another. Therefore it is possible that 100 Bitcoin from abroad will flow into the economy. At the end of the reporting period there is therefore in the economy 1100 bitcoins and 103 produced goods. For a good there is in average 10.679612 of bitcoins. Bitcoin economy in these circumstances may show the inflation trend that is out of control of anybody.

3.2. Historical example of rigid money supply and its impacts

Historical experience with rigid supply of money exists in a capitalist economy, e.g. in the form of a system of national banks in the USA, which replaced the so-called era of free banking. The two main objectives of the national bank were to create a single American currency and raise funds to finance the Civil War. The system was legally supported by National Banking Act, adopted in 1863, amended due to deficiencies in the following year. The essence consisted in the creation of banks that meet the minimum capital requirements. These banks had to dispose American federal bonds of specified class as a guarantee for the money subscribed. Money was possible to subscribe up to 90% of the market value of bonds, from 1900 up to 100% (Champ, 2007, p. 5-8).

The system of national banks succeeded in implementation of the single currency, although it remained possible to issue their own banknotes. However, they were burdened by increasingly larger taxes and therefore quickly disappeared. The national banks represented a compromise between the era of free banking and central banking. Without a central bank, it implemented the single federal currency. It brought a degree of control over that currency and support of the government bond market to federal government. The biggest drawback of the system of national banks was the inability to regulate the quantity of money in circulation. It was dependent on the market value of government bonds. The decline in the market value of government bonds meant limiting the supply of money in the economy. Constriction of loans from national banks transmitted decline in the market value of government bonds in the real economy. The rigid money supply, a result of both the above-mentioned measures, stemmed from the fear of oversubscription of currency (Selgin and White, 1994, p. 207-208).

The national bank system suffered from several crises in the years 1873, 1884, 1893 and 1907, the crisis was essentially a combination of the above described inelastic money supply and fluctuating money demand, evolving from a predominantly agrarian nature of the economy then. Depending on the agricultural cycle, there was a withdrawal of money from the bank on the east coast to the agricultural west. Lack of money turned partly on the stock exchange in New York and also led to the

suspension of payments and related banking panic. In the most severe crisis in 1907 almost all banks in the country suspended the payments (Champ, 2007, p. 13-26).

Similar difficulties can be expected in real bitcoin economy. The loss of government control over its own currency, combined with easy and very fast transferability of bitcoins would lead to the uncontrolled inflows and outflows or on the contrary too much rigidity in the money supply.

3.3. Possible global Bitcoin economy

For further analysis we assume a kind of bitcoin global economy, which does not alow transfer of bitcoins. According to the already mentioned, such economy would necessarily have to be deflationary. Supporters of bitcoin admit this fact, but do not see it as a problem. According to their argument, the rise of value of saved bitcoins is positive for the individual (as opposed to inflation affected holders of other currencies), for traders who will prefer to accept bitcoins with long growing value over steadily depreciated ordinary money (bitcoin.stackexchange.com). The fear of falling into a deflationary spiral does not exist, because if the deflation is problem of common currencies, it does not mean that it is the problem of bitcoin. Expected, long-term and stable deflation will be accepted in bitcoin economy in the same way as inflation is accepted in the current economy (bitcoin.org/en/, deflationary spiral).

While the first part of the arguments can be rejected with reference to not fully considering effects of deflationary spiral, the second part of the argument deserves more attention. The theoretical background of this thinking is the Austrian School. Money is perceived as commodity money, i.e. certain commodity, which has been transformed into money by market mechanisms. The nature of money is only useful for its exchange value. The size of the money supply is fully determined by market mechanisms (including non-monetary use of funds / commodities) and if that offer is more or less rigid, then with the higher volume of consumer goods production, the value of monetary units increases. The phenomenon of retention of money for later appreciation is described by the Austrian school, but also it is not perceived as a threat, but as a simple result of market mechanisms (Rothbard, 2001, p. 39-46).

In connection with this theoretical concept it is necessary to draw attention to the difference. Bitcoin may be useful to its users in terms of their exchange value, nevertheless as has already been shown in the first part, it is very questionable what bitcoin represents. Probably it is not a commodity, as is required by the representative s of the Austrian school (as argued by Matis, 2011), but it cannot be denied that its choice as money is a matter of market mechanisms.

Representatives of the Austrian School point to the myth of neutrality of money in the form of uneven distribution of new money in the economy in case of inflation (Mises, 1980, p. 160-168). From this criticism conclusion is drawn that deflationary money is a better alternative. Such a conclusion, however, only ignores the fact that deflation is also characterized by uneven redistribution. For example, if inflation exists in debt obligations, the redistributive effect is in favor of the debtor, in case of deflation, it benefits creditors.

In an inflationary environment, where money over time loses its value, it is worthwhile to spend it as soon as possible. Given the need to save some resources to ensure

oneself in a non-profit period of life, the answer is to convert savings to investments. Although it brings some risk, the current markets provide investors with a high level of protection. Both consumption and investment have a positive impact on the development of the real economy.

In a deflationary environment on the contrary, it is worth to delay consumption. If the growth rate of real product is consistent with a decline in the price level, it makes sense to wait to buy unnecessary goods later. Postponement of consumption, however, has an impact on the profitability of investments due to declining aggregate demand. According to the aforementioned arguments of proponents of bitcoin economy, however, the effect of delayed consumption does not occur. Consumers will not long satisfy their consumption and postpone their consumption behavior therefore in comparison with the current situation there will be no change (Roberts, 2011, as cited on bitcoin / wiki / deflationary spiral).

Against this argument two objections can be raised, one theoretical and one empirical. The theoretical objection is the question of why should businesses invest at all, if the funds are appreciated just by its simple existence. It is an attitude of economic entities to real investment.

In an inflationary environment, the investment is an instrument for achieving additional return, for example per 100 monetary unit invested, entity wants to acquire 105 units per time period, while due to inflation, the value of the original 100 units equals 103 units at the end of the investment period. Two units are profit, due to which the economic operator had to cede a risk that with a certain probability it does not reach the desired yield.

How would such reasoning go in bitcoin economy? Knowing the deflationary nature of the bitcoin, economic entity, a holder of the bitcoin as monetary unit, must be aware that a certain probability of investment leads to growth of real product (e.g. 3%), and therefore to appreciation of bitcoins held. The essential difference compared to the inflation environment is risk exposure. The investor bears the risk in both inflationary and deflationary environments. In a deflationary environment the risk is higher due to dangerously declining aggregate demand. Households in an inflationary environment face the situation that their savings will depreciate if they are not turned into investment and therefore must accept a certain level of risk. In a deflationary environment, however, tenure is not connected to any risk. Money seemingly appreciates itself as a result of investment activities of others. Why a rational household would took risks and gave their savings to be invested, when they can be appreciated without any risk?

The issue can be expressed using game theory. Using the following formula to calculate net domestic product, let us assume that consumption, net exports and government spending are constant:

Formula 3: Net domestic product

$$NDP = C + I_N + G + E_N$$

Net investment is the important factor influencing the level of the product. If $I_N = 0$ then there is no product growth. The threat that the consumption C could be reduced is neglected. The other factors are not related to the character of Bitcoin economy and therefore also neglected.

The situation of the individual is expressed in model called the tragedy of commons. This is a non-cooperative game, against which it could be argued that market participants have the opportunity to communicate their intentions. This is in practice highly questionable. The idea that households were discussing among themselves the amount of savings converted to investments is not quite real. Note, however, that in an inflationary environment, this is automatically ensured.

In this model, a household decides whether to cooperate with others and invest or not to cooperate, and not invest. If all invest together, although bearing the risk of investment, at the same time they achieve higher production (and additional return on investment) and thereby decrease of the price level. In the event that both individual households and everyone else decide not to cooperate, and make no investment, then currency units will not appreciate because the real product does not increase. However, if the strategy not to cooperate is chosen by only our individual households, the gains of their savings due to the decline in the price level without incurring any risk. The yield in this case is the highest.

Example of possible of values yields shown in the following table.

Table 1: Tragedy of commons

		The others			
		Not to invest		To invest	
Individual	Not to invest	-1	-1	5	3
	To invest	-2	-1	3	3

The above mentioned example shows that the dominant strategy of the individual will be not to invest, because this option gives him the highest possible risk-adjusted returns while possible loss is lower than loss if he decides to invest but others not.

Deflationary environment turns the perception of price movements, taking for example wages. If the decline in the price level is implicit part in the bitcoin economy, price for the work must necessarily fall adequately as well as. Assuming growth of labor productivity, the nominal decline of wages must be lower than the decline in the price level. The result is real wage growth, but that can seem a little confusing and paradoxical to employees.

The stated economic relationship would make wage policy and social well-established agreement much more difficult. An example might be union negotiating wage growth. While in an inflationary environment, the unions try to negotiate an agreement with the highest possible wage increases (and if they want to achieve real wage increases so at least by the inflation rate), then the employer is seeking an agreement to raise wages to a minimum. It is essential that both sides must find an agreement. To the employer it is clear that if wages are not increased, he will face the departure of employees and thus his future ability to make a profit is endangered. In a deflationary

environment, on the other hand a reduction in wages would be negotiated. The unions would like to reduce wage only by minimum, but the employer as much as possible. Leaving aside how odd such negotiation would be in today's economic relations, we cannot ignore the fact that the most successful unions will be the ones that negotiate no agreement. That would force the current wage rates. While in an inflationary environment, employees could respond to declining real wages by leaving, the only possible strategy would be to close the employer's business and set up a new one. This of course is not in the real economy easily managable. Because even the dismissal of employees is relatively expensive (severance pay and other negotiations with trade unions) this may be another obstacle in the development business. Of course, it is clear to unions representatives that not to make any agreement on wages will eventually lead to the shutdown of the company and thus the end of paid wages, but costs are fatal for both sides.

Deflationary environment has paradoxical consequences for prices of investment assets in the form of securities. When the price level is decreasing, income of businesses decreases as well. As already explained, the higher the investment activity, the more companies´ profit will decrease. Logically stock market prices must fall as well, because the purchasing power of money, bitcoins is growing. While in an inflationary environment profit is compared with the rate of inflation, in a deflationary environment it would be compared with the rate of deflation. But the situation is getting extremely complicated. If the investor buys a share for 1 BTC, then price drop to 0.97 BTC, does not mean in a deflationary environment a decrease in the value of the company, but the growth of the purchasing power of bitcoin. But it is the same situation as in the case of the above described real investment. Why would investors buy stocks with the expectation of a decline in value, when it would be preferable to retain and not to invest 1 BTC? Investments would be beneficial in the situation where the company was able to increase its value eg. to the price of 1.1 BTC per share. The informational role of prices, however, is more blurred.

The empirical objection lies in the fact that deflationary environment is not to a modern economy so unknown. The most famous example is Japan, whose economy has been in a deflationary environment over two decades.

Table 2: Macroeconomic indicators of Japan

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
CPI (2010=100)	100,7	101,9	102,4	102,1	102,1	103,7	104,4	104,0	103,1	102,2	101,0
GDP growth in %	0,8	0,2	0,9	1,9	2,6	1,6	-2,0	-0,2	2,3	0,4	0,3
Money stock (M2) change in %	0,600	1,058	2,050	3,033	3,250	3,066	4,008	3,575	2,117	2,783	3,308
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
CPI (2010=100)	100,7	100,7	100,3	100,6	100,7	102,3	100,8	100,0	99,7	99,7	100,2
GDP growth in %	1,7	2,4	1,3	1,7	2,2	-1,0	-5,5	4,7	-0,5	1,4	1,5
Money stock (M2) change in %	1,683	1,858	1,792	1,008	1,567	2,092	2,708	2,775	2,742	2,517	3,608

Source: CPI - Statistics Bureau of Japan; GDP - OECD; Money Stock - Bank of Japan

As can be seen from the table, the price level between 1992 and 2013 slightly decreased. It is remarkable that this happened at the same time as the growth of the money supply. If this growth was not happening, the price level would drop a lot more. The above data given about growth, respectively stagnation of gross domestic product

indicate that this period can be described as very successful. Although the factors of economic stagnation in Japan are deeper, it can be argued that deflationary environment greatly helps and the above mentioned assumption of followers of Bitcoins about elimination of deferred consumption in the long term deflationary environment does not fulfill.

4. Banks and bitcoin

Supporters of bitcoin and Bitcoin see its extension as a tool for change of current, particularly financial, of world. Bitcoin is supposed to become a tool to limit excess financial intermediation, especially in two respects.

The first is Bitcoin as a payment system. The simplicity and low costs of Bitcoin transfers on a global scale no doubt exist (Brychta, 2014, p. 8). Standard money transfers via correspondent banks, possible monitoring of transactions using data from the SWIFT system (Sobek, 2014) and fee cost to the transferor of money rather agree with this argument. A greater protection of the money transferor from his own mistake cannot be ignored. Sending bitcoins to the wrong account means their irrecoverable loss.

The second reported example is founding of a Bitcoin bank Neo & Bee in Cyprus. This bank was founded without a standard subscription of shares through IPO by simply sending bitcoins (Brychta, 2014, p. 9). In order to better analyze this argument it is necessary to clarify what is a bank and what activity is carried out by organization Neo & Bee.

Functional definition of a bank characterizes a bank as "*an institution whose current operations consist of lending and borrowing deposits from the public*" with emphasis on the word "current" in the sense of "regular" or "main" as a distinguishing feature of the bank from other business entities whose activity has the same characteristics, but only on a casual basis (Freixas, 1998, p. 15).

The legal definition in European law does not speak specifically about banks, but the Credit Institutions, and these being defined in Council Directive EC no. 77/780 / EEC as a business whose activity is to receive deposits or other repayable funds from the public and provide loans for its own account.

When comparing the above mentioned definitions of a bank with the activity of organization Neo & Bee, it is evident that it is not a real bank and the designation is misleading. The main product of Neo & Bee is standard Bitcoin wallet that allows users to store their money. Neo & Bee´s profit comes from a charge of conversion between bitcoin and the euro. This basic wallet service is expanded into other two products. It is a kind of temporal wallet, where the user holds bitcoins for the specified time. They are then sold back to the euro, however, a higher rate is assumed. Although the product looks like bitcoin equivalent of term deposit, in fact it is a monetary investment. The third product is a wallet hung on the euro. Stored value in euros always corresponds to the value in bitcoins. The product is therefore on the one hand supposed to offer easy access to the payment system in Bitcoin network but also has to protect standard bitcoin wallet against volatility. A complementary product is called Bee card. Basically it is a debit card allowing payments in bitcoins (neo-bee.com).

Neo & Bee is not an institution that would provide any loans, which it excludes from the definition of a bank. Neither its function accepting deposits is not implemented. Neo & Bee provides de facto management of bitcoin account for the user who does not want to do it on his own. Access to the entire payment system is connected to this management. The remaining products are already working with currency risk. They are trying to make a profit on either in the form of de facto FX operation, or by providing protection against volatility in exchange rates. Rather than a traditional bank, this organization is on the border between payment service provider and currencies broker.

Declared innovative approach of setting up Neo & Bee will not hold with closer examination. After a single taxing of deposits in Cypriot banks, the possibility of opening alternative financial institutions necessarily had to get some number of interested people. Above indicated, allegedly revolutionary procedure for obtaining capital for Neo & Bee, does not bring any innovativeness in reality. In the same way it would be possible to do everything in current money. Even when we admit the existence of an innovative approach, it is not based on Bitcoin. Alternative forms of financing such as crowdfunding are implemented without Bitcoin. Acquisition of capital took place in September 2013 in a reported amount of 10 thousand bitcoins. It was at that time the equivalent of 1 million USD. It is worth mentioning that the same number of bitcoins in December 2013 corresponded to 10 million USD. Neo & Bee began its operation in late January and early February 2014, however the effect did not last long. The founder of the bank has been missing since early April 2014, and at the same time there were reports of robbed clients (Markides, 2014). Activity of the company was soon ceased and given to the course of its formation, it is not surprising that the company could be even created. It seems that the Neo & Bee child specific circumstances.

The reason of very rapid end, if from the beginning it was not the intention to carry out the fraud, could be the fact that the products of the "bank" Neo & Bee were based on rising prices bitcoin. That would indicate that the whole concept was not appropriately thought over. In the period since the set-up of the "bank" until the disappearance of company representatives, bitcoin exchange rate against the dollar has been dropping steadily, as shown in the following graph.

Graph 3: Price of bitcoin in 2014

Source: Google Finance

The story of Bitcoin bank Neo & Bee does not represent any example of functional model of Bitcoin banking. In order to consider the possibility of using Bitcoin as currency (as it is required by its supporters) and not only as payment system, the issue of functional banking system must be solved. Developed economy without efficient loan providing cannot be imagined.

In terms of core banking business, getting deposits and providing loans, the main obstacle is that Bitcoin cannot be lent (Fillner, 2014, p. 8). The only way how to get bitcoins is to purchase them, there is no way how to get a bitcoin loan. When the user received bitcoins to his/her wallet, he/she is considered as their owner and is the only one who can send them to other accounts/wallets. To better understand this qualitative difference it is important to realize that legal money is linked to the banking system (cash is out of consideration now). If the bank credits someone's account by providing a loan, the account holder is indeed the owner of money but in the case of ignoring its obligations arising from receiving the loan - its proper reimbursement including interest - may be penalized. Penalties may take place either in the form of penalty interests, account blocking and even if the user sends the received loan money to other banks, it may be executed on the basis of court's decisions. The bank simply, on the basis of execution request, debits the relevant account and sends money to the entitled counterparty.

Bitcoin as a completely decentralized system does not allow such procedure at all. If the transaction (the loan providing) is confirmed, it cannot be canceled. No other option exists to subsequent withdrawal of bitcoins from account of the receiver because there is no authority that could do it from technically point of view. The only person who can dispose with bitcoins on the account is the account owner that knows the right password.

A possible solution to loan providing could be opening of special accounts. This kind of accounts would be opened by the bank and the bank would be also the only one who would know private key to their authorization. The recipient of the loan would possess the money only in an indirect way. The recipient always has to contact the bank and based on submitted documents, he could claim a payment from the amount of money of provided loan. Such approach would be cumbersome but is more or less acceptable for such loans as mortgages or investment loans to companies, as it largely corresponds to the established practice. Such procedure, however, does not cover the entire range of loan types as they are used today. How an ordinary consumer credit could be maintained? Similarly, it would be hard to set any pre-arranged credit limits to client's accounts.

Direct bitcoin lending is problematic in the respect of getting deposits. Loan providing solution discussed above could work for cases when a bank lends its own capital (its own bitcoins), but the modern banking system does not work in this way. However, the bank cannot lend bitcoins that it does not own. For the acquisition of bitcoins, the bank needs some that would be provided by its clients. Such a process requires a lot of trust from the clients because the client would waive 100% control over his/her money. It does not seem to be strange in contemporary financial system, but it should be reminded that full control over money is one of the pillars of confidence in Bitcoin. Experience has shown that such trust between the institution and its customer in

Bitcoin economy can be easily disappointed. An example is the case of the very short life of "bank" Neo & Bee, but the best known case is the loss related to bankruptcy of Bitcoin Stock Exchange Mt. Gox in February 2014 in which clients lost about 750,000 bitcoins (Kasík, 2014). The same problem happened to Czech Bitcoin Exchange called Bitcash in November 2013 (Lázňovský, 2013).

This procedure assumes that the bank is only an intermediary of transactions that accepts deposits and provides loans in bitcoins. In this scenario bitcoins are on both sides of bank's balance sheet as shown in the following table.

Table 3: Bank balance sheet; lending of bitcoins

Bank balance sheet			
Assets		**Liabilities**	
Lent bitcoins	100	100	Bitcoin deposits

In this above mentioned case the bank is not the issuer of any money and there is not any change of the amount of money in circulation. Problem of this solution are the technical principles of Bitcoin.

An alternative solution bypassing Bitcoin restrictions would be to allow the issuance of money by the banks, which would be fully covered by bitcoins. The advantage of these issued money is the fact that it keeps the same characteristics as current money in terms of their association with bank accounts. Regarding the requirement of full coverage of money, the deflationary character of Bitcoin economy is not eliminated.

The Bank would become the issuer of money, but as shown in the following diagram, the amount of money in the economy would not be changed, because the number of bitcoins in circulations would be reduced.

Table 4: Bank balance sheet; issuing of "loan currency"

Bank balance sheet			
Assets		**Liabilities**	
Bitcoin reserves	100	100	Bitcoin deposits
Loans in issued currency	100	100	Issued currency in circulation

This approach would allow banks to live up to their financial intermediary function based on transformation of money. This approach seems to be friendlier for depositors. Depositors, in the case of their high confidence in the bank, could use the bank as a manager of their wallets. In the case that they would not have such confidence, they could enter into contracts with the bank on term deposits. Bitcoin system allows monitoring transactions on specific accounts and therefore it could be checked whether bitcoins are really there, where they should be. The user would be only pledged not to use his/her bitcoins for a certain period of time. This would create a quantity of bitcoin reserved for bank that would enable to issue equal amount of "loan currency". Banks would still have to worry about its liquidity to ensure that it has sufficient amount of reserved bitcoins as underlying assets for "loan currency".

Unfortunately, even this approach opens some serious problems. First, it is necessary to determine whether each bank would issue its own, unique, “loan currency”, or whether the “loan currency” would be common at least in certain areas. Emissions of various “loan currencies” by many banks would mean following the idea of free banking, which would be rather untransparent situation. Discussing and arguing this approach goes beyond the scope of this paper. Using one “loan currency” seems like simpler solution. However, it is absolutely necessary to technically secure, that there could not be more bitcoins in circulation than there are deposited in favor of the bank. Otherwise, the system loses its credibility.

Problems arising from using this scenario would be considerable. In the economy double money would circulate, bitcoins and “loan currency” derived from bitcoins. Even in the case of a simple parity eliminating the need for dual pricing, the functionality of this approach would require technical support of two payment systems. Each service or goods could be paid either in bitcoin or in “loan currency” and certainly a situation when someone refuses to accept “loan currency” because of reluctance to participate in the next payment system would occur.

Interesting effects of the bitcoin economy implementation could be found for interest. Because Bitcoin is based on the vision of decentralization, the central bank would become unnecessary – Central bank could only provide some kind of control of credit money. The main interest rate would disappear from the economy with the absence of central bank. There would not simply be any central authority that would provide liquidity or allow to get rid of excess liquidity. The entire process would take place only on the interbank market, where banks could sell or buy deposits. The interest rate would be entirely result of supply and demand forces.

5. Conclusion

It was showed by comparing the characteristics of Bitcoin with commonly used definitions of money (theoretical, empirical and legal) that although Bitcoin is widely reported to be money, it does not meet criteria of used definitions. Legal definitions rather ignore the nature of Bitcoin and in the case of Bitcoin being explicitly mentioned in the law; it is done in connection with prohibiting of usage.

Monetary aspects of Bitcoin were largely neglected, although Bitcoin supporters really think about digital currency as a currency that could replace currently used money. Therefore, it appears relevant to think about monetary aspects of this project. It was shown by a thought experiment that the single bitcoin economy is not immune to inflation and it annuls one of the putative benefits of Bitcoin economy. Only thinking about global Bitcoin economy leads to a clear conclusion about its deflationary nature. However, an example from the area of game theory shows that this kind of economy would lead to a risk-averse investment attitude and thus cease of investing activities at all. In addition to the distortion of information function of price there is also an experience arising from the Japanese economy with long term deflationary environment that shows that the objection about deflationary nature of Bitcoin has to be taken seriously.

Every developed economy requires an effective system of money lending that is currently conducted mainly by banks. We cannot really talk about Bitcoin economy

without creating Bitcoin lending. Current Bitcoin institutions do not fulfill this role and due to the character of Bitcoin, and effective Bitcoin banking seems to be very difficult to conduct.

The most innovative contribution of Bitcoin remains in the function as a payment network. However, it cannot be missed that operations of this network are not guaranteed and bear certain risk. If there was another efficient payment network implemented by banks or official institutions in the future, and if this payment network brought appropriate guarantees as those provided by current payment system, the competitive advantage of Bitcoin would be eliminated.

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