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Some Monetary And AI Aspects Of Cryptocurrencies

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Abstract

With the emergence of cryptocurrencies, the question of the role and importance of cryptocurrencies in the payment systems and monetary functions of cryptocurrencies was raised. In this short discussion, we look at the importance of cryptocurrencies from the aspect of conventional functions that fiat money has in modern economies. One of the key advantages of cryptocurrency that is insisted upon is the decentralization of its creation. The decentralization of the money creation process negates the controlling role of central banks, which is of key importance for the functioning and stability of the monetary system based on fiat money and protection of the financial system as a whole, protection of consumers and the general public. Starting from the traditional functions of money, we consider which of these functions cryptocurrencies currently perform successfully. In this context, starting from the textbook definitions of money in the practices of some central banks, we try to determine the place of this new form of money in the context of definitions of money and its substitutes. Cryptocurrencies do not fit into the classic or standard definitions of money and its functions. After the gold standard system, it is hard to imagine any new form of money or monetary system that would not be controlled by central banks. The emergence of Bitcoin, "blockchain" and "cryptocurrencies" to many observers, this high-tech financial innovation beggars belief that it is possible to create conditions for the creation of innovative democratic monetary instruments. The achieved popularity of cryptocurrencies raises the question of whether these innovative financial instruments can replace the classic money provided by central banks. At the very start, the problem of using these currencies in everyday payment processes performed by households arises. The current characteristics and dynamics of the cryptocurrency market and the comparison of their characteristics in relation to fiat money cause skepticism regarding the possibility that these currencies will replace standard monetary systems in the foreseeable future. It seems that the expectations regarding cryptocurrencies are exaggerated. Cryptocurrencies have increasingly become very attractive investment assets in recent years. Their role as a means of payment comes into the background. The development of artificial intelligence corresponds with the growth and use of cryptocurrencies. Due to its new possibilities, artificial intelligence is becoming a very powerful tool in the hands of investors who can now manage their investments more easily and efficiently. This is especially important when it comes to cryptocurrencies whose market value is extremely volatile.

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1. Introduction

The last decade has been marked by the emergence and use of cryptocurrencies in payment transactions, where, on a much wider scale, they serve as a medium for investments. The popularity of cryptocurrencies, where we can even talk about a kind of fascination with these new currencies, has opened up numerous questions that are widely discussed in the public, professional and scientific circles. The question of the true character of cryptocurrencies, the scope of their use in the future, the reality of expectations and the problems they cause as a financial innovation based on high technology for public policy and regulation is still not sufficiently resolved. In the following presentation, we will look at the central question, which is whether cryptocurrencies, in accordance with the general perception, can be considered as a money or a close substitute for money. We will examine what characteristics of money, cryptocurrencies may eventually possess and to what extent they match in modern definitions of money. In addition, we will look at the contemporary challenges faced by the cryptocurrency market segment as a whole. At the end, we make a special review of the role of AI during the decision-making of investors about investing in cryptocurrencies

1.1 What are crypto currencies?

Cryptocurrencies, also known as virtual currencies, are digital assets that leverage cryptography to ensure secure transactions and regulate the creation of new units. The name "cryptocurrency" (the "Crypto" is the Greek word "Kryptos" meaning "hidden") means that contents are accessible only to sender and receiver. It was designed to allow peer-to-peer (or person-to-person) transactions, without the need to know or that you have confidence in the other person in the transaction. Unlike traditional currencies, cryptocurrencies operate on a decentralized network structure based on blockchain technologies. This means that there is no central authority (such as a bank) controlling the issuance and transfer of these currencies. Private players create cryptocurrencies, and there is no limit to how much can be transferred between parties within the network. The system is not regulated by statutory authority, it is decentralized and it is managed by distributed consensus. (Palgrave Handbook of Technological Finance, 2021). The most well known cryptocurrency is Bitcoin launched in 2009. The system was designed to electronically mimic features of a cash transaction. The integrity of the Bitcoin system is protected by 'cryptography', which is a method of verifying and securing data using complex mathematical algorithms (or codes). This makes the system very difficult to corrupt. (https://www.rba.gov.au).

Bitcoin transactions are verified by other users of the network, and the process of compiling, verifying and confirming transactions on the basis of complex codes is often referred to as 'mining'. The Bitcoin system increases the complexity of these codes as more computing power is used to solve them. A new block of transactions is compiled approximately every ten minutes. 'Miners' want to solve the codes and process transactions because they are rewarded with new bitcoins (currently 6.25 new Bitcoins per block).(https://www.rba.gov.au).

Cryptocurrencies have no legislated or intrinsic value. They are simply worth what people are willing to pay for them in the market (and, in theory, its value could fall to zero at any time) (https://www.rba.gov.au). This is in contrast to national currencies, which get part of their value from being legislated as legal tender.

There are several thousands of cryptocurrencies existing around the world. More than two hundred traded cryptocurrencies, the most famous of which are: Bitcoin, Ethereum, Binance Coin, Cardano, Tether, Litecoin... At the beginning of 2024. over 6000 different

cryptocurrencies were registered. Their capitalization is currently equal to the value of 1.5 trillion US dollars. (www.coinmarketcap.com). The total value of money according to the definition of M2 (effective money plus various short-term deposits and low-value savings deposits with banks and other financial institutions) in the whole world in 2022. amounted to 92.7 trillion US dollars (www. visualcapitalist.com). The total capitalization of Bitcoin is currently about 800 billion dollars (www. coinmarketcup.com) This means that Bitcoin represents only about 0.9% of the value of the total amount of money in the world. These relationships are variable due to the large fluctuations in the market value of Bitcoin, but even if they double or halve, nothing important changes. In addition to all that, it should be kept in mind that Bitcoin is primarily an investment financial asset and that only a small percentage of Bitcoin is used for current payments. If it is viewed as a financial asset in a broader sense and not exclusively as money, then we can see that in the total world financial assets (255 trillion dollars, www.bcg.com) Bitcoin participates only with 0.3%. We can conclude that Bitcoin still does not have the capacity to endanger the traditional monetary systems.

Digital currencies are mainly cryptocurrencies. A block chain must have blocks and chains. If there are no blocks and chains, it is not a cryptocurrency. Facebook tried to introduce LIBRA (later renamed DIEM), which was conceived as a stablecoin whose value was supposed to be tied to US government securities and a basket of leading currencies. As of 2020, Facebook has faced resistance from regulators because it has no blockchain . Practically, it would be a new currency that, with the permission of the regulator, would be backed by certain assets (the company would act as the Central Bank). Since Facebook has an excessive number of users, it is quite understandable that the monetary authorities, i.e. the regulators, stopped such an initiative of a private institution, not allowing the entry of private money into the competition with official money.

The question of definition is also how many versions of centralized stablecoins belong to cryptocurrencies. It is about digital money that, for the sake of stability, is linked to some other value such as some official currency (dollar, euro...) or a basket of currencies or some basket of values/prices. Although the question is to what extent is the blockchain one that not everyone can access, but only those who have been granted access to it.

According to a report by Chainanalysis (www.chainanalysis.com), digital assets in the global market reach a capitalization of 1 trillion US dollars. Relatively the largest use of cryptocurrencies in 2023. was registered in India, Nigeria, Vietnam, USA, Ukraine, Philippines, Indonesia and Pakistan, Brazil and Thailand. . In the 11th, 12th and 13th places are China, Turkey and Russia. In developed countries, in addition to the USA (4th place) and Great Britain (14th place). The reasons for the widespread use of cryptocurrencies are not the same in all countries. In countries with high labor migration, the transfer of wages to home countries has the lowest costs if it is done through cryptocurrencies. There are also countries with highly inflated national currencies (Turkey, for example). Holding savings in cryptocurrencies is a form of protecting the purchasing power of earnings. In the developed world, the use of cryptocurrencies is mostly related to institutional investing. In countries where sanctions are applied, cryptocurrencies help to overcome these restrictions more easily. Similarly, in the war economies (Ukraine, Russia...) distrust in institutions and flight of capital is expressed. Cryptocurrencies can effectively serve to avoid paying taxes.

Global payment giant Visa recently enabled its users to directly exchange their cryptocurrency for fiat currencies without using centralized exchange. The user can now withdraw cryptocurrencies like bitcoin directly from a wallet like MetaMask to a Visa debit card and pay at 130 million merchant locations where Visa is accepted (145 countries, at least 40 cryptocurrencies) (https://cointelegraph.com/news/).

Public policies in many countries are faced with the question of how to limit the use of digital currencies in criminal activities. Given the anonymity provided by cryptocurrency systems, and their worldwide reach, cryptocurrencies have become a very convenient way for money laundering, embezzlement, illegal trade, financing illegal activities, etc. Decentralization makes government control difficult. Bitcoin, Monero, and Ethereum are just a few of the cryptocurrencies that have offered opportunities to be used in crimes like tax evasion, money laundering, drug trafficking, and terrorism financing. Approximately a quarter of Bitcoin users and half of its transactions were related to illegal activities, with an annual value of $72 billion in illegal activities being connected to Bitcoin on the darknet (Foley, at al. 2019).

The current fascination with cryptocurrencies has potentially added to the speculative nature of these markets, and has raised concerns around consumer protection. The expansion of the use of cryptocurrencies presents challenges for the banking sector and raises concerns about the financial stability of the system, i.e. the potential for causing financial crises.

The existing regulations are largely inadequate and ineffective in the fight against money laundering through cryptocurrencies. Bajaj at al. (2022) suggests the regulations governing cryptocurrency are still at an infancy stage, and it still suffers from the challenge of limited transparency. Liechtenstein's blockchain law could serve as a benchmark for regulators around the world looking to address this issue. Teichmann,. and Falker, (2021), provide insight into cryptocurrency crime and Liechtenstein's response for legislators, law enforcement, compliance officers and regulators.

2. Centralization vs. decentralization

The creation and use of cryptocurrencies does not only involve a number of technical issues, but is primarily about the arrangement of relationships. The main point of the introduction and use of cryptocurrencies is to avoid the authority of central monetary institutions that create and control money, or ultimately states. Cryptocurrencies are created (issued) decentralized, which ensures their mutual competition. That is why many cryptocurrency advocates look back and refer to the thought of Friedrich von Hayek, as a representative of the free market concept (libertarian ideology), which would take away the right of the state to create money because the state's monopoly necessarily leads to the misuse of money. (Hayek, 1998 p.113-115). That is why he advocates for the issuance of money by private entities, which would establish competitive relations between privately issued currencies. The fact that Hayek has the gold standard system in mind and advocates for it should not be overlooked. The increased complexity of the financial system at the time made him cautious, so he asked himself: what is good money? In the system of paper money, even private issuers would have to take care of limiting the money supply (Hayek, 1976.p.4,).

The emergence of cryptocurrencies can act as an ideal opportunity for the realization of Hayek's idea that money is created decentralized, without a central bank. Proponents of cryptocurrencies who believe in the unlimited possibilities of cryptocurrencies in the process of replacing traditional monetary systems would most likely assume and say that Hayek would like the idea of cryptocurrencies (Phaneuf , 2023).

Cryptocurrencies are similar to Fiat money (but Hayek preferred the gold standard). Behind the Fiat money of the central bank can be financial assets such as government securities, foreign exchange reserves or monetary gold, which is not the case with cryptocurrencies. Their price of cryptocurrencies is very volatile and its value is not known from day to day. In 2021. the BIS assessed that it is a speculative asset rather than money and as such cannot be money.

A stablecoin that has coverage or partial coverage in dollars practically resembles a bank deposit. The ability to maintain at par value depends on the quality, riskiness and liquidity of this asset, and ultimately on the monetary policy of the central bank. . In this way, it completely moves away from Hayek's idea of competitive currency. By creating a cryptocurrency of central banks, it could lead to the historical irony that central banks are not only monopolists of money, but also of deposits, loans and personal financial information. This can be evaluated as an extremely unfavorable (dialectical reversal) scenario that would centralize the monetary system even more and make the central bank even more powerful than before, which is in complete contradiction to Hayek's idea (Pollock, 2022).

3. Are cryptocurrencies money?

3.1 Research overview

Central bank experts will always say that cryptocurrencies are not money. Despite the increased level of interest in cryptocurrencies, central bankers express skepticism about whether they could ever replace more traditional payment methods or national currencies. (https://www.rba.gov.au).

Practically, cryptocurrencies are payment instruments, saving and investment instruments. Activity in cryptocurrency markets has increased significantly. The fascination with these currencies appears to have been more speculative (buying cryptocurrencies to make a profit) than related to their use as a new and unique system for making payments. Related to this, there has also been a high degree of volatility in the prices of many cryptocurrencies.

For example, the price of Bitcoin increased from about US$30,000 in mid 2021 to almost US$70,000 toward the end of 2021 before falling to around US$35,000 in early 2022. On September 11, 2023, it was at the level of US$25,000 and at one point in January 2024, its value reached US$39,956 (https//cointelegraph.com). Such high fluctuations in the market value of cryptocurrencies can cause huge losses for investors, especially those who are not professionals.

In the very rich professional literature, somewhat different views can be found. The general public is mostly subject to marketing and PR where Bitcoin is presented as a gold coin with the letter B and a dollar sign which should make a very clear association that it is real money. The very large ignorance of the general public about monetary issues and the digital world, as well as susceptibility to propaganda, makes cryptocurrencies be considered money quite uncritically. The public's understanding of the role of cryptocurrencies is best reflected by Wikipedia, whose definition of cryptocurrency states that cryptocurrency is a type of digital money that operates on the basis of cryptographic algorithms. "It has all the *features of a real currency*, except that it is not backed by the authority of the state and exists only in electronic form." (https://hr.m.wikipedia.org/wiki/)

We will see in the further presentation that cryptocurrencies do not have all the characteristics of money and that they are not real currency precisely because there is no central monetary authority behind it.

The conventional definition of money is broadly conceived in the sense that it is claimed that "money is everything that is generally accepted in exchange" (Dornbush, 1998.p.336.). Existing literature has paid attention to distinguishing the disparity between private money and public money or digital money (Bitcoin) and fiat money, such as the US dollar (Brunnermeier and Niepelt, 2019; Schilling and Uhlig, 2019). The difference between money and cryptocurrency is determined through the prism of their ability to be an effective medium

of exchange, unit of account and store of values. (Baur and Dimpfl, 2021). In his article, Yermack (2015) states that Bitcoin is not money because it functions poorly as a money. Jumde and Cho (2020) found that fiat money is still preferred to cryptocurrency due to many reasons. Hazlet and Luther (2020) states that bitcoin is money because demand for cryptocurrencies is equal to demand for official money—though perhaps only over a relatively small domain at present. Cahachanosky (2019) points out that Bitcoin in particular, and cryptocurrencies in general, do not have a good monetary rule and that this shortcoming seriously limits its prospect of becoming widely used money. An et al. (2021) argue that digital currencies only show the potential to inject liquidity into an economy during market stress.

Villaverde (2019) points out that cryptocurrencies are a bubble without a fundamental value and they will not provide, in general, optimal amounts of money or deliver price stability. Ammous (2018) concludes in his paper that digital currencies' rigidly inflexible supply and wildly fluctuating demand make them too unstable to be used as a unit of account for the foreseeable future. Due to its low supply growth, Bitcoin in comparison to other cryptocurrencies has the potential function of storing value. Credibly backed by the network's distributed protocol and credible demonstration of the absence of any authority capable of altering the supply schedule. It becomes apparent that Bitcoin is not real "money" but relies on existing currency, concludes Rahmatian (2019) At present, its actual role is rather to enable speculation and to circumvent fiscal regulations."Synthetic commodity money" resembles fiat money because it has no intrinsic value and resembles commodity money because it is absolutely scarce. Selgin (2015) believes that such money can provide the basis for a monetary regime without any monetary authority yet is able to provide for a high degree of macroeconomic stability. However, one must not lose sight of the fact that the key obstacle for a monetary system without a central monetary authority is the insufficient supply of these currencies, as was the case with commodity money (gold) a long time ago. Fama , Fumagalli, Lucarelli (2019) concludes that Bitcoin is a highly speculative financial asset, but socio-technical innovations introduced by Bitcoin have concretely opened the possibility of deeply rethinking money. Aware of several major limitations that follow Bitcoin to be a means of exchange, the authors ask whether this experience can pave the way for the birth of new and more democratic monetary instruments, which includes a whole combination of political, technical and social elements. Malherbe et al. (2019) discuss the issue of trust in cryptocurrencies, which is of crucial importance in the monetary and financial system in general. They believe that trust is now in the form of a technical institution, the blockchain. Gronwald (2019) discusses in his paper how similar Bitcoin is to a commodity. While the short-term supply of gold and oil are uncertain there are no uncertainties on the Bitcoin supply-side. Thus, the observed movements of Bitcoin prices can be interpreted as results of Bitcoin demand shocks. The empirical results of the Bitcoin exchange rate dynamics in a study by Hui at al.(2020) show that the Bitcoin exchange rate shares some characteristics of commodity currencies with crash risk. This suggests that Bitcoin behaves as a currency between fiat money and a crypto-commodity used for trading and investment purposes.. An at al. (2021) argues that digital currencies only show the potential to inject liquidity into an economy during market stress.

Cryptocurrencies still do not have any influence on the monetary policy conducted by the central bank. The quantum of cryptocurrencies is almost negligible in a relative sense compared to the amounts of money of central banks and financial institutions. In addition, only a small part of the total amount of cryptocurrency is used for payments. For now, we can only talk about the effects of certain types of monetary policy in the US and the EU on the cryptocurrency market (Sören 2021). The role of the central bank will be exhausted on the

regulation of the cryptocurrency market and consumer protection. When it comes to central bank cryptocurrencies, they will regulate and manage their digital currency in much the same way as they have regulated the amount of effective cash in the economy.

3.2 Definitions of money

From the long and rich history of money, we know that in the past a huge number of objects were used in exchange (from shells to other incredible things such as stones, which for example were in use for 1500 years on a island Jap, skin from the head of a red woodpecker, whale teeth, cattle , cigarettes and many more or less unusual items).

Can parallels be drawn between cryptocurrencies and the stones that were used on the Polynesian island of Yap and can still be found on that island. The stones were in the shape of a wheel with a diameter of about thirty centimeters to 4 meters. The stone was mined and processed on the island of Palau, about 400 kilometers away, and hauled in on primitive rafts. Stone processing lasted from 6 months to a year. Stones were a measure of value, a means of exchange and a means of storing value. It was generally accepted by the islanders. Considering the considerable weight of stone money, during transactions the stones did not even have to be transferred from the buyer to the seller, but the memory of which stone belonged was simply preserved in the collective memory. Even if the stone is lost during transport, it remains in the function of payment because, although it is at the bottom of the sea, it is known whose ownership it is. In this way, it functions in circulation as a claim recorded in the collective memory, knowledge and consciousness of the islanders.

When we compare the Rai stone currency from the island of Yap and cryptocurrencies, we see that they have in common that there are no real values behind these currencies, so they have no cover. The truth is, "creation" of one and the other currency is based on a lot of work and costs (human work, work of computer systems and high consumption of energy). Both are scarce and limited. However, "stone money" has an advantage over cryptocurrencies because it is a *sui generis* money because it is accepted without restrictions and the value of the commodity is measured by the "quantity" of the stone. Therefore, no other measure of value is required as is required in the case of cryptocurrencies whose value must be expressed in dollars, euros or other currencies because the prices of goods and services are defined in those currencies.

This leads us to think that a lot of material things, goods and objects could be found in the role of money. Many things can be used in exchange, but under one condition that it is generally accepted. Money is an institution that is a matter of social convention. Therefore, in order for something to serve as money, the willingness of the wider public to accept it as money, that is, as a means of payment, is necessary. The general acceptability of cryptocurrencies has not yet been achieved, and as it seems now, this will not be the case in the distant future either. For this reason, cryptocurrencies cannot be classified as money according to its narrower definition, which implies, among other things, that money has its nominal value that does not change over time (one hundred dollars is nominally always one hundred dollars). Cryptocurrencies have a value that is formed on the market (with the exception of stablecoins that are tied to some hard currency or some other asset), which is why their value changes almost daily. Cryptocurrencies are not even close substitutes for money that can be converted into money very quickly and easily with minimal costs at some unknown date in the future at a known nominal price. Despite the best will, it is not possible to find any element within the standard definitions of money that refer to cryptocurrencies, or which cryptocurrencies fulfill. A new definition of money would have to apply to cryptocurrencies, which would read "that money can be *anything that someone or anyone*

wants to accept in exchange". The history of money is full of examples that would fit into this hypothetical definition of money.

In the fiat money system, as opposed to the gold standard money, the money issued by the central bank cannot be exchanged for a fixed amount of gold or any other precious metal, which was possible in the gold standard system. The paper on which money is printed, or the metal from which coins are made, is worth almost nothing compared to the face value of the bill or coin. This means that behind fiduciary money there must be full confidence of the money holder that he will be able to exchange it for desired goods and services (Plakalović, 2004, p. 26). In order for the fiduciary monetary standard system to function, it is necessary for all transactors to accept banknotes, coins, checks, payment cards (central bank money and bank money) without restrictions. Another important condition is the predictability of the purchasing power of money. Acceptability means that everyone is willing to receive money because they know that they will be able to exchange it for goods and services based on previous experiences. Predictability in the system of fiduciary money means that its price, measured by the amount of goods that can be exchanged for one unit of money, can be predicted. This means that his purchasing power must not change quickly, that is, it must be kept stable. The purchasing power of money is preserved if the ratio of supply and demand for money is kept stable. With the change in the prices of goods and services, the purchasing power of money also changes.

With more intensive price growth, it does not mean that money will not be used to perform current transactions, but the behavior of transactors in terms of the choice of financial assets that they will hold and thus the amount of money that they will hold will also depend on estimates of how much the value of money will be lower in the future. The emergence of technological innovations has affected the erosion of the border between money and other financial assets. Central banks could not directly manage the amount of money in circulation, which is why monetary policy shifted to influencing the nominal interest rate, which changed the relative rates of return on different financial assets.

Definitions of money can be different. The transactional approach with money treats only those payments that are made with a universally accepted means of payment. Money is viewed exclusively in its role as a means of payment. Value can be stored in all forms of assets (financial and real, now also digital), while in payment transactions only some funds are accepted as a means of exchange or payment. Therefore, money in the narrowest sense is money of the central bank (paper money and coins and soon also digital money of central banks) and money in the current accounts of bank clients (transaction money, practically bank money) on the basis of which clients can issue checks or use different types of card. The difference between money and other financial assets is its absolute liquidity (the most liquid part of the asset). The liquidity of an asset is measured according to how easily it can be converted into money, at some unknown date in the future, at a known nominal price, in the short term with minimal costs (Miller ad van Hoose , 1993. p. 44.). Money in this case is seen as part of the property. All assets have a certain degree of liquidity, the only question is how much the nominal value of the asset changes when it is transferred into the most liquid asset, money, what are the costs and how long does it take. In this way, other funds that come out of the traditional definition of transactional money can also be considered as money. It is important that they can be converted into money quickly, without losing their nominal value and with low costs. Assets whose nominal value will not change in the future and on which no nominal gain or loss is possible are perfectly liquid assets. For this reason, central banks include numerous other categories of liquid financial assets in the definition of money.

Judging by these definitions, cryptocurrencies could hardly be classified as liquid assets. Leaving aside the accompanying transaction costs, the highly variable market value and its unpredictability in an immediate time frame, and especially in a longer time horizon, do not allow cryptocurrencies to be considered perfectly liquid assets.

4. Central Bank Digital Currency (CBDC)

Contrary to Hayek's idea of decentralizing the issuance of money, the introduction of Central Bank Digital Currency (CBDC), which China and the EU are already approaching, would mean strengthening the role of the central bank in the monetary sphere. The emergence of cryptocurrencies has opened up space for the digitization of central bank money, which reinstitutionalized the role of the central bank. In 2021, the FED was still in the phase of discussing this matter and the potential consequences and future policies in this sphere of financial technological innovations. (Kolakowski, 2021).

A Central Bank Digital Currency (CBDC) is a digital form of cash. It can be issued by the central bank. That form would be accessible to the general public, and used to settle transactions between firms and households. The unit of account would be the national currency, and it could be exchanged at parity (i.e. one for one) with other forms of money, such as physical currency or electronic deposits with well-regulated financial institutions. (https://www.rba.gov.au).

Central bank digital money cannot be or does not belong to cryptocurrencies because it does not arise in spontaneous decentralized processes of cryptocurrency "mining". CBDM refers to the official currency issued by the central bank. The introduction of central bank digital money would in fact be merely giving digital form to paper money. It is possible that such kind of cash would reduce the need to use cryptocurrencies.

The possibility of the European Central Bank introducing a digital euro is being seriously considered. It would only represent a supplement to cash payment instruments. Its nature would be identical to the nature of cash because transactions between entities would be performed outside of bank accounts. Privacy in transactions would be preserved. Of course, one could only control the conversion of deposits and digital money and vice versa. The introduction of the digital euro should not mean the abolition of classic paper money. CBDC issued by the ECB would be used within the countries of the European Union. The introduction of digital money by some central banks can be expected soon. The ECB plans to introduce a digital euro worth 1 to 1.5 trillion euros in 2025. The goal is to escape negative effects on monetary policy. Permissions on an individual holding of digital euro is 3000-4000 euro with using cards on mobile apps.

Brunnermeier and Niepelt (2019) ask the question: When does a swap between private and public money leave the equilibrium allocation and price system unchanged? Their results imply that CBDC coupled with central bank pass-through funding need not imply a credit crunch nor undermine financial stability.

In mature market economies, the central bank implements its monetary policy by acting on the banking credit market and the money market. Many autonomous factors affect the supply and demand of money. It does not act on certain categories of money supply according to its definitions of money. Through bank lending operations and the purchase and sale of government and other securities, and by manipulating the discount rate, it directly and/or indirectly affects the supply and demand of money, i.e. it balances them. The Central Bank continuously monitors the supply and demand of money on the market and interest rate levels and responds promptly . If it is not more directly involved in the banking market, it intervenes

in the money market by simultaneously buying and selling securities. This means that any excessive increase in liquidity on the money market caused by a significant inflow of cryptocurrencies that could affect the demand for bank money and central bank money would be compensated by defensive actions of the central bank on the banking and money market with standard monetary policy instruments. Therefore, it is difficult to expect that the coexistence of "legal tender" and cryptocurrencies could have some disciplining effect on central banks, as, for example, Belke and Beretta (2020) believe.

5. Artificial intelligence and cryptocurrency investing

During the relatively short history of the emergence and use of cryptocurrencies, it turned out that the popularity and disproportionate demand for digital currencies in relation to their supply influenced that cryptocurrencies primarily began to be used as investment digital assets. According to some estimates, around 90% of existing bitcoins are stored on exchanges and cryptocurrency trading platforms. In this way, the accounting of bitcoins is centralized in contrast to the decentralized accounting that exists when "mining" (broadcasting) and "finding" cryptocurrencies.

The reason for the entry of investors into the cryptocurrency market is the enormous growth of their market value and returns in a relatively short period of time. From 2019. to 2022. Bitcoin annual return has reached a staggering 143% (Huang, 2024) . Traditional financial markets cannot provide such a return. Recent research looks for the potential change in the cryptocurrency market to hedge market risk and predict abnormally high returns. It seeks practical applications that can be integrated with traditional financial markets, such as diversified portfolio, hedging strategy, and safe-haven application (Huang, 2024).

Cryptocurrency research is designed according to their attributes as financial assets or currency used in exchange. Bitcoin as a financial asset is analyzed using traditional asset pricing methods. Starting from the currency attribute, the possibility of using bitcoins in the exchange of goods and other related applications is analyzed.

The development of digital currencies coincides with the development of AI. The dominant use of cryptocurrencies as investment assets has also influenced that the possibilities of applying AI and machine learning in the analysis of the cryptocurrency market are being increasingly applied and researched. It is obvious that without the application of AI, it will not be possible to invest effectively in digital assets in the markets.

Machine learning models show satisfactory performance in quantitative finance, although it can be concluded that it is still in its initial stages. Bouslimi et al. (2024) refer to several studies where it is indicated that machine learning is a fruitful alternative to econometric modeling and that machine learning achieves higher forecasting precision than widely accepted econometric approaches.The novel methodology based on machine learning proposed by Vieitez et al. (2024) offer the two investment strategies. They have been designed for Ethereum (ETH), based on predictions of the price and trend of this cryptocurrency using real data. Investment strategies are designed that validate the models and allow profits.

Large amounts of raw data are produced daily and they need ’’cleaning’’ by researchers. The paper Saxena et al. (2024) presents the predictions of the values of cryptocurrencies by preparing the data set efficiently. Their goal was to use Artificial intelligence machine learning algorithms and models to anticipate and forecast the closing price of the cryptocurrency, making it easier for users to trade these currencies.

According to a study by Jin (2024), users of AI technologies who are investors in block chain technologies, cryptocurrencies and non-fungible tokens (FT) have a higher perception of blockchain transparency than non-investors, a greater interest in cryptocurrencies and a higher perceived value of NFT assets than non-investors.

Artificial intelligence can identify factors that affect cryptocurrency prices and find risky currencies (Zekiye et al. 2023. Iliev and Panwar 2023. Alessandretti et al. 2018). Machine learning models give better performance in predicting cryptocurrency prices (Aworunde et al. 2021). Application areas related to trading are volatility prediction, portfolio construction and fraud detection. Liu and Zhang (2023) present an automated trading strategy advised by the PU ratio that outperforms conventional buy-and-hold and market timing strategies.There are other challenges related to mining, cyber security , anonymity and privacy. Artificial intelligence (AI) techniques are not limited to machine learning (ML) techniques (supervised, unsupervised, semi-supervised, and reinforcement), but also include evolutionary-based techniques and knowledge-based techniques (Sabry et al. 2020. Amirzadeh et al, 2022.). Lennart snd Ender (2023) reveal significant abnormal returns for 90% of AI tokens after the launch of ChatGPT, up to 41% over the course of two weeks. The research of Almeida snd Goncalves (2024) contributes to the existing literature by providing a nuanced understanding of how technological advancements like ChatGPT influence market efficiency in emerging AI-Crypto markets. Their results suggest that market efficiency in these sectors is not static but evolves with technological innovations and sector-specific characteristics.

Recently, there has been talk of a combination of artificial intelligence (AI), big data and cloud computing. Blockchain is revolutionizing the production of information technology systems and various applications. It is estimated that the combination of AI and blockchain has a huge potential for the development of new models of financial services based on digitalization. The benefits of using an integrated AI and blockchain platform are being talked about across many financial services platforms. Cryptocurrencies are accompanied by issues of cyber security, mining, privacy, anonymity as well as regulatory challenges that regulators must address (Hosen et al. 2022). Zhang (2022) discusses the need to establish a framework for the allocation of digital currency. The two existing methods Proof of Work and Proof of Stake make it possible. The first method is used more by service providers because it does not have high limits and is more balanced. Artificial intelligence can help improve this method and make the new framework work more efficiently. The AI assistant can monitor the entire transaction process and ensure that the validation is acceptable.

6. Conclusions

Although there is a widespread perception among the public about cryptocurrencies as the most modern version of money, it is very difficult to consider such forms of financial assets as money in the full sense. There are many limitations and features of virtual money to be considered real money. Like fiat money, there is no real value behind virtual money. However, behind the paper money stands the authority of the central monetary institution, which ensures the general acceptability of its money and ensures the preservation of its purchasing power. Virtual money is often compared to gold due to its rarity. However, the gold standard money (whether it was made of precious metals or paper money) was completely or partially covered with gold, while behind virtual currencies there is practically absolutely nothing, but it could be said that there is a big "void". Trying to include cryptocurrencies in one of the official definitions of money, we can only state that this type of "money" cannot be considered like money by any element. It has no nominal value other than market value, it does not fit the definition of perfect liquidity, which is the key characteristic

of official money. Cryptocurrencies are not definitive and legal means of payment, so they cannot function without official currencies in which prices are calculated and which serve as a measure of value. Therefore, for many payments, the conversion of cryptocurrencies into legal money is necessary. And perhaps most importantly, crypto-currencies, unlike central bank money and, in general, bank money, do not have the characteristic of general acceptance. Acceptance of such money is always a matter of agreement between the two parties. Finally, the central bank can limit and regulate its use if it considers that it competes with the official currency, which could eventually happen only in the case of enormous creation and use of cryptocurrencies in the payment process, which is currently uncertain. On the other hand, some Central Banks are preparing for the introduction of their own digital currencies (CBDC), which replaces a significant part of the effective paper money in circulation and achieves some of the practical benefits of using digital money. Although privately issued, they cannot be a competitor to official money because they have very few characteristics of money (limited use in the payment process) and thus are not useful in the realization of the libertarian idea of competing private money. Without the money of the central bank, it would be impossible to perform standard functions of Central banks, which is why it is unthinkable to replace the money of the central bank with private currencies. In this context, the emergence of cryptocurrencies represents only a challenge for the regulatory authorities, which, among other things, have to solve the problems of abuse made possible by the emergence of cryptocurrencies. This primarily refers to the widespread use of cryptocurrencies in crimes like tax evasion, money laundering, drug trafficking, and terrorism financing. The dominant use of cryptocurrencies as investment assets has led to an ever-increasing exploration of possibilities and the application of AI and machine learning in the analysis of the cryptocurrency market. The use of AI is primarily related to the forecasting of cryptocurrency price changes and the analysis of portfolio management. The use of AI and machine learning becomes very useful in solving the problems of cyber security, mining, privacy and anonymity.

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