

REVIEW PAPER

Cryptoeconomics: Financial Market Security Aspects and Implications for Managerial Accounting

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ABSTRACT

The development of modern information technologies and the processes of globalization are key factors for the emergence and spread of virtual currency. The legal status of cryptocurrency is still uncertain. It is considered both as a modern means of payment and as a speculative tool for illegal activities. However, despite such diametrically opposed interpretations, the fact that economic realities are constantly changing is unconditional. The IFRS reporting system is no exception, which should adapt to new challenges in a timely manner and take into account the need to disclose information about new progressive elements as much as possible. The article aims to analyze the economic and financial essence of cryptocurrencies, assess the phenomenon of the crypto economy and its impact on the financial market and monetary policy, as well as to outline appropriate implications for the corporate level – namely, for management accounting. The methodology is based on a theoretical analysis of cryptographic protocols and tools for investment and macroeconomic analysis, some approaches of economic theory. It is shown that although today cryptocurrency is a speculative, high-risk instrument, cryptoeconomics is increasingly integrating into the global financial market, while the potential risks of this process still outweigh its benefits. Accordingly, at the micro-level, management accountants must understand the related risks and be able to explain the implications to the management team and the board of directors. The originality of research consists of an attempt to combine the analysis of macro- and micro-implications of emerging crypto economics based on an economic theory foundation.

HIGHLIGHTS

- The article considers cryptocurrency as a speculative, high-risk instrument and analyzes its implications for the security of the financial market and managerial accounting within crypto economy landscape

Keywords: Cryptoeconomics, Cryptocurrency, Bitcoin, Financial market, Risk, Security, Regulation, Management Accounting, Enterprise, Digitalization, Financial Information

It can be stated that today a new component of the world economy is emerging, the crypto-economy (or digital economy), which, in our opinion, implies a set of technologically new goods and services and related infrastructure, new ways of storing, exchanging information, new forms of control over the fulfillment of obligations of any level. Cryptocurrencies, like blockchain, gave impetus to the emergence of completely new markets; they are the foundation, a kind of fuel for the digital

economy, which is the reason for the increased interest of large market players in them.

There are many applications of blockchain technology, including in the financial system, and interest in them is high among banks and other

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financial institutions. For example, blockchain allows speeding up payments and money transfers, significantly reducing their cost, and its value is high for stock markets (for example, this technology is already used by Nasdaq) and decentralized prediction markets (for example, Augur).

It is impossible to ignore the fact that simultaneously with the confrontation (or interaction?) between banks and fintech companies, a parallel independent cross-border financial system is being formed in the world. New business models have the potential to move many banking operations into an unregulated industry. It can be argued that crypto economics has become such a parallel economic reality today.

Almost all existing cryptocurrencies are characterized by low liquidity and limited emission. Thus, experts have calculated that in quantitative terms, Bitcoin will not exceed 21 million. According to the calculations, the end of the release of Bitcoin is expected in 2140 (Voshmgir, 2023). The emission process itself is characterized by complexity and cost. The presence of low liquidity makes any asset overly volatile, with minimal fluctuations in supply and demand. Thus, investors are not immune from the collapse or growth of the exchange rate, which means that the risk of losing funds is much higher. Analysis of the data of the largest cryptocurrency exchange, Bitstamp, allows talking about rises and falls of the bitcoin/dollar pair during the day. For international settlements, the stable nature of the currency is important, and therefore, the main reserve currency at the present stage is the dollar (Berg *et al.* 2019).

It is worth noting that the anonymity of transactions makes cryptocurrencies an ideal tool for drug and arms trafficking, withdrawal, and money laundering, which poses a threat to the economic security of the country. It was on Bitcoin that the largest trading platforms of the shadow Internet worked. Cryptocurrency speculation carries a risk for the global financial system since all traded digital currencies are not backed by anything, and their quotes can change rapidly.

Today, a number of experts believe that Bitcoin is a Trojan horse of the monetary system, as it eliminates control of money (Yue *et al.* 2021). Over the next decade, as the crypto economy expands its reach to become truly global, the financial system will

appear in jeopardy as its foundation shifts from public funds to decentralized digital currencies. If Bitcoin becomes widespread and legal, it will push all banking companies to reduce costs in order to remain competitive (ESMA, 2022).

Bitcoin and digital currencies will always be cheaper monetary systems to maintain and use than cash, which must be protected from bank fraud, note destruction, and physical theft. Fiat money will always be more expensive to maintain and use the overall monetary system than any digital currency system. Digital currencies can scale much more safely and efficiently than cash. The use of cryptocurrencies implies the waiver of additional processing times and fees. The independence of Bitcoin makes it more stable than traditional currencies, but high volatility deters many investors and carries the risk of losing invested funds. The state will not be able to protect investors in the event of rate fluctuations or deception by cryptocurrency sellers. In essence, Bitcoin is a speculative investment (Baur *et al.* 2018).

Due to the insecurity of Bitcoin, banks are wary of this new payment method. Some states allow it to circulate as a currency, some perceive it only as a speculative tool, and some, like China, prohibit it altogether.

With regard to bitcoin, the tragedy of sharing systems is that bitcoin is not backed by anything but is unusually popular and in high demand among speculators, which keeps the price of bitcoin continuing to rise at a superfast pace (Munoz & Frenkel, 2022). There is a risk that one day such a financial pyramid will collapse, and then investors who have invested in Bitcoin, speculators, and people who use Bitcoin to pay for purchases or as savings will suffer. Such an event, of course, will also affect the financial market, which could trigger a new crisis.

The evidence of high risk becomes especially apparent in view of the fact that “interconnectedness with the wider financial system has been growing. Linkages between crypto-assets and the euro area banking sector have been limited so far, although market contacts indicate there was growing interest in 2021, mainly via expanded portfolios or ancillary services associated with digital assets (including custody and trading services). Major

payment networks have also stepped up their support of crypto-asset services, leveraging their retail networks and making crypto-assets more easily accessible to consumers and businesses. Some institutional investors (hedge funds, family offices, some non-financial firms, and asset managers) are now also investing in Bitcoin and crypto-assets more generally ... For example, since July 2021, German institutional investment funds have been allowed to invest up to 20% of their holdings in crypto-assets. This is further aided by the increasing availability of crypto-based derivatives and securities on regulated exchanges, such as futures, exchange-traded notes, exchange-traded funds, and OTC-traded trusts, which have increased in popularity over the last few years in Europe and the United States" (Hermans *et al.* 2022).

The entire value of modern cryptocurrencies is the result of the balance of supply and demand in their specific market. While the state guarantees traditional money is an official means of payment they are accepted by banks, they are taken into account by all citizens, and business entities, and a certain cryptocurrency may turn out to be useless one day. This is the reason for such significant fluctuations in the exchange rate of cryptocurrencies in the market. For example, the exchange rate of bitcoin against the dollar:

- ♦ 03/12/2020 4830 USD/BTC (minimum for 2020);
- ♦ 12/31/2020 – 28983 USD/BTC (the maximum for 2020 is the difference from the minimum for this year by 6 times);
- ♦ 04/14/2021 63354 USD/BTC (so far the maximum for 2021);
- ♦ 07/04/2021 34689 USD/BTC (almost half the high of 2021).

As one can see, even within a short period, fluctuations are very significant. Moreover, the exchange rate changes several times in a few hours in one day (Werbach, 2018).

Today, "the development of blockchain technology and distributed ledger technology (DLT) causes opposed judgments about the prospects of traditional institutions in the digital economy: from their complete disappearance to a radical transformation. This issue applies to the field of accounting as well as audit and management control (Armstrong *et al.* 2019; Hyytiä & Sundqvist, 2019).

The secret of the success of modern business is largely determined by the company's readiness for technological innovations. An important result of the emergence and development of crypto-economics has been the identification of factors hindering the implementation of digital initiatives. First of all, this is related to the issue of digital trust, reliability and transparency of the company's business processes. However, at the same time, this comes into conflict with the principles of management accounting and 'due diligence' paradigm. A gap in the theory of management accounting regarding the changed paradigm of information about the world around us leads to the fact that in the modern world the classical approach to the use of information no longer allows conducting enterprise management activities efficiently enough. First of all, information that may affect an enterprise or organization may often not carry the most direct economic connotation, sometimes simply foreshadowing events. These events, again, may not play, at first glance, a significant role or not have a significant economic effect on the organization's activities.

Thus, not only a comprehensive analysis of the implications of crypto-economics for the security of financial markets but also the need to adapt management accounting processes to the conditions of crypto-economics, its increasing integration into economic and financial processes becomes an important task.

MATERIALS AND METHODS

The methodology of this study is based on a theoretical analysis of cryptographic protocols proposed in 2008 by the founder of the Bitcoin crypto economic system Satoshi Nakamoto, as well as their compliance with the principles of "system theory", proposed in 1969 by the Austrian scientist Carl Ludwig von Bertalanffy, and the fundamental principles of behavioral economics, proposed in 2002 Nobel laureate Daniel Kahneman.

This analysis contributes to the identification of economic principles embedded in cryptographic protocols, the degree of security of using such cryptosystems and determining the relationship between their behavior and the behavior of economic agents. The main interest of the authors is related to identifying aspects of the further development of cryptoeconomics for the potential inclusion

or consideration of new methods from various economic disciplines, which, like cryptoeconomics, are interdisciplinary.

LITERATURE REVIEW

There is no clear definition of the term “cryptoeconomics” in the scientific literature. It should be noted that Vitalik Buterin, a programmer and founder of the Ethereum blockchain platform, made a significant contribution to the development of the theoretical provisions of crypto-economics and its practical forms of implementation. Buterin, in his lecture on crypto-economics, argues that crypto economics is a combination of cryptography (the science of information security), computer networks, and game theory, which ensure the formation of reliable systems for economic incentives (Buterin as cited in Caliskan, 2023).

Speaking about crypto economics, Parker Thompson, a venture capital investor from the American high-tech cluster commonly known as Silicon Valley, wrote the following: “The concept of crypto economics is stupid because it is really just about classical economics. Inventing your word is just an excuse to ignore established concepts” (Thompson, as cited in Berg *et al.* 2019).

Economist J. Robinson argues that most modern currency systems are not backed by any commodity, such as gold in fact, they are based on faith in the currency (trust) (Hacioglu, 2019). As a result, those who do business through the use of fiat currency demonstrate more trust in their government. Essentially, any fiat currency depends on the faith of nations in its value appreciation and redemption by the issuer. Although the US has a huge economic, cultural, and military power in the world, the value of the dollar is increasingly volatile. The ability of the US to repay its debts is not in doubt, since such doubt could cause a crisis of confidence. So, back in August 2011, the rating agency Standard & Poor’s downgraded the US rating from the highest AAA to AA+1 (Werbach, 2018).

The United States, represented by the Fed, gives out money that they use to buy their own debt. This has created an unsustainable system, and the situation has been exacerbated since the US economy went off the gold Standard in the 1970s. Centralized banking, as well as the lack of a means by which to track the actual value of the dollar and financial

deregulation policies to stimulate economic growth, have caused threats to economic stability over the past four decades. It was a time of major expansions in the economy, often based on consumer debt. Breakdowns in the system accompanied them, the consequences of which, for example, since 2008, are still observed (Armstrong *et al.* 2019). Accordingly, the growth of interest in the use of cryptocurrencies may demonstrate a low level of public confidence in the state public administration system.

Before turning to the issue of regulating cryptocurrencies, it is worth noting that many states until 2012-2013 did not pay attention to the market due to its insignificant volumes. However, due to the growing popularity of cryptocurrencies and the emergence of increasingly new opportunities for their use, countries began to see this as the need to determine the rules of the game. It is important that today, the regulation of crypto-economics, individual entities, and processes is carried out in the world based on the public goals of the state and is aimed at neutralizing the objective risks of money laundering and terrorist financing, as well as erosion of the tax base.

According to Canadian experts from the leading consulting companies Ledger Labs and Blockgeeks Lab, which provide services for creating blockchain networks, “the term crypto economics causes a lot of confusion, and people often do not understand what it means. The word itself can be misleading, as it suggests a parallel “crypto” option for the entire economy” (Brekke *et al.* 2021). Obviously, namely for this reason, the aforementioned Parker Thompson makes fun of such a generalization.

A review of the literature devoted to the study of issues of crypto-economics allows concluding that crypto-economics is an area of applied cryptography, but not economics (Voscuil, 2020). At the same time, it certainly takes into account economic incentives and economic theory. As for such blockchain platforms as Bitcoin, Ethereum, Zcash, they are just products of cryptoeconomics.

Describing the phenomenon of cryptoeconomics, experts write that its fundamental feature is a decentralized system based on P2P protocols, which deprives centralized state actors of the ability to control (Masharsky & Skvortsov, 2022). At the same time, they immediately stipulate that it is necessary

to proceed from the fact that, one way or another, subjects will appear who will seek to disrupt the operation of the system.

In view of the previous, it seems important to determine to what extent crypto-economics is a field of study of the humanities, classical economics based on the laws of the market, as well as the degree of security of the system being created, which almost entirely depends on cryptographic codes and computer algorithms.

As for accounting for cryptocurrency transactions and, accordingly, its integration into management accounting, many experts are inclined to believe that cryptocurrencies are a specific class of intangible assets (IA) acquired for investment purposes and have an active market. This class can also include certain types of licenses, domain names, etc. (Hyytiä & Sundqvist, 2019).

Indeed, cryptocurrencies meet the criteria for intangible assets (Girasa, 2022):

- ♦ They can be separately identified and sold;
- ♦ They are a non-monetary asset;
- ♦ They do not have a physical form;
- ♦ They are highly likely to generate future economic benefits.

Given the price volatility of cryptocurrencies and their value solely as a medium of exchange, the only logical method of their accounting after recognition is through revaluation. However, paragraph 85 of IAS 38 Intangible Assets prohibits recognition of an upward revaluation in profit or loss, requiring an entity to recognize such an increase within other comprehensive income (Armstrong et al., 2019). This approach to valuation is due to the fact that intangible assets are historically considered as long-term investments designed to contribute to the economic activity of the enterprise. Such an interpretation of intangible assets, of course, runs counter to the essence of cryptocurrencies as highly liquid assets used for trading or investment purposes.

The literature, in particular, provides an illustrative example: the Australian company Bitcoin Group Ltd considers bitcoins as part of intangible assets. As required by IAS 38, a company first recognizes bitcoins at acquisition cost and subsequently revalues them to reflect the price in an active

market. Revaluation upwards is made through capital. The downward revaluation first reduces the positive revaluation of prior periods in equity, and the remainder is recognized as an expense in the current period. After bitcoin is retired, the revaluation reserve is included in retained earnings (Ibrahim *et al.* 2021).

Another equally important way of accounting for cryptocurrencies is to recognize them as reserves.

IAS 2 defines inventories as assets:

- (a) held for sale in the ordinary course of business;
- (b) in the process of being produced for such sale.

If the main activity of the company is related to the trading or mining of cryptocurrencies, then it seems more correct to account for them as reserves, rather than intangible assets. This conclusion is supported by IAS 38 Intangible Assets, which contains the following disclaimer: "If another Standard prescribes the accounting for a specific type of intangible asset, an entity applies that Standard instead of this Standard. For example, this Standard does not apply to an entity's intangible assets held for sale in the ordinary course of business." (IAS 38 Intangible Assets, paragraph 3a.) (Katippearachchi, 2018).

In our view, the gaps in regulation provide room for some flexibility in the application of the standards from the standpoint of preparers. Suppose it is fundamentally important for an entity to reflect changes in the fair value of cryptocurrencies in the income statement. In that case, it may apply the exception provided by IAS 1 Presentation of Financial Statements. According to paragraphs 19-20 of the Standard, in the extremely rare circumstances where management concludes that compliance with a requirement in the Standard or Interpretation could be so misleading as to conflict with the objective of financial reporting as set out in the Framework, the entity shall waive such a requirement, if the relevant legal framework prescribes or does not prohibit such a derogation.

Regardless of the accounting method chosen, detailed disclosure of information about the use of cryptocurrencies by an enterprise and the risks associated with it is of utmost importance. The

completeness of disclosure increases the likelihood that the chosen method of accounting will be accepted by the auditor without reservations and a paragraph on attracting attention in the auditor's report. This information can be disclosed directly as part of a note to the relevant reporting item, in a description of a business or accounting policy, in a note to capital management, which is the basis for management accounting.

RESULTS

Cryptoeconomic approaches combine cryptography, which is applied computer science, and economics, which is a field of the humanities, to create reliable decentralized P2P1 networks that will evolve over time despite attempts to confront them. The cryptography behind these systems is what makes P2P communication within networks secure, and the economy is what encourages all actors to contribute to the network to help it evolve gradually (Liu & Tsyvinski. 2021).

From the point of view of modern global digital transformation, the key advantages of the cryptoeconomic system are reliability, stability, and security (see Table 1).

Table 1: Key advantages of cryptoeconomics

Advantage	Description
Reliability	Decentralized systems are less prone to random failures because they rely on many individual components.
Attack resistance	Decentralized systems are more expensive to attack and damage or manipulate because they do not have sensitive central points that can be attacked at a much lower cost.
Collusion protection	Participants in decentralized systems find it much more difficult to collude and act in a way that benefits them at the expense of other participants, while corporate and government leaders can, in theory, collude in ways that benefit themselves but hurt less well-coordinated actors, citizens, customers, employees and the general public.

Source: Drawn up by the author based on various sources' data and opinions.

Based on the considered approach, which is used in the cryptoeconomic system, it can be argued that this system is an interdisciplinary field of study and

requires a deep understanding of both cryptography and economics. Economic mechanisms have implemented a protocol that allows the creation a universal management (so-called super-system) layer, which, before the advent of Bitcoin, was not available even to computer science. Bitcoin and its derived public blockchain technologies are products of cryptoeconomics that have the function of ensuring consensus between entities that do not know each other (Werbach, 2018).

However, it should be noted that the security aspect depends very much on how strong people's economic incentives are, and how people respond to incentives is precisely the area of study in economics. Cryptoeconomics, thus has much in common with the design of mechanisms, as well as the field of economics associated with game theory.

Cryptoeconomic networks are inherently complex socio-economic systems that are dynamic, adaptive, and multi-level in nature. Their dynamism is formed due to the flow of information and network resources. Adaptability is determined by the ability to adjust behavior depending on the environment, directly in the case of Bitcoin, or, more broadly, through the decisions of operators. The multi-level nature is determined by local protocols that have spatial macro-scale properties according to the "no double spending" principle, which, according to experts from the University of Pennsylvania, guarantees their access to the global level (Hacioglu, 2019). Thus, their design requires a strong interdisciplinary approach to develop robust protocols that take into account spatial and time dynamics.

In the interests of our study, we will consider crypto economics in its modern form as an alternative decentralized economic system designed to exchange economic and financial information between users through channels that provide a high degree of protection and anonymity. Decentralization, the almost complete lack of regulation, and the significant involvement of system users in its development led to the formation of independent infrastructure and institutions of crypto economics, which largely repeat or replace the infrastructure of the traditional financial and banking system. Cryptoeconomics also has its mechanism for investment and financial intermediation. It is advisable to consider this mechanism in terms of the

financial risks it poses to users of the system: credit, market, and operational risks, as well as corrective information risks (Demertzis & Wolff, 2018).

Speaking about credit risk, it should be noted that due to the principle of decentralization, there is no concept of “central bank” in crypto economics. A system based on blockchain technology implies the transfer of the functions of issuing money, making payments, and implementing monetary policy to the system participants themselves. It should be emphasized that the function of the lender of last resort is also entrusted to the participants in the system.

Let us analyze these functions on the example of Bitcoin cryptocurrency. The users of the system carry out the issue of bitcoins. They receive a portion of bitcoins in the form of a reward for adding the next block to the transaction database. Users provide the computing power of their computers to maintain a distributed platform and create new blocks, i.e., ensure the transfer of financial information and the processing of payments. As it is widely known, this process is called mining. The issuance of new bitcoins is decentralized, it does not depend on any regulator, the volume of emission is known in advance. There is a graph of the number of bitcoins until 2033. Thus, the crypto community itself determines monetary policy.

Alternatives to issuing cryptocurrencies through mining are forging and ICO (Sadraoui *et al.* 2021). In the ICO (Initial Coin Offering) process, by analogy with the IPO, there is an initial placement of tokens or crypto-currencies. Through ICOs, issuers raise funds for the implementation of a particular technological project. Investments in a token can be formalized as an interest-bearing loan, purchase of a share of an enterprise or a share of profit (similar to shares), donation, barter exchange, payment for services, receiving bonuses or discounts, paid registration (for example, to access an online resource), etc. In addition, investors can count on speculative income from the growth of the exchange rate of the token/cryptocurrency, receive dividends, or participate in project management (as when owning ordinary shares).

Due to the absence of a lender of last resort, a regulatory framework, and an investment insurance system, investors take full credit risk, i.e., in this case,

the risk of non-fulfillment of contractual obligations by the issuer of the token/cryptocurrency. In order to reduce the credit risk for investors, specialized rating agencies have recently begun to appear that offer services for the analysis and scoring of ICO projects. The activities of such agencies are aimed at eliminating fraudulent projects (“scams”) and an objective assessment of projects that are going to raise funds from investors in the ICO format, but the level of risk still remains high.

In addition, the escrow mechanism is becoming increasingly more widespread in the ICO market. In the context of ICO, an escrow is a special account that holds property, documents, or funds until certain circumstances occur or certain obligations are met (Yen & Cheng, 2021). Thus, one can observe the first signs of self-regulation in the ICO market and in the crypto economy in general, which helps to reduce the credit risk for investors. However, it is still quite difficult to predict and evaluate other financial risks for investors in crypto-assets.

There is also market risk. It should be noted that the cryptocurrency market is extremely speculative. This is confirmed by the high ratio of trading volume per day to capitalization. For bitcoin, this indicator is the most stable and low of the major cryptocurrencies. However, it is 1-5%. For comparison, in the US stock market, for the largest companies, this parameter is usually much lower than 1% (even at the sensational Facebook IPO it was 0.5%) (Yue *et al.* 2021). A feature of the cryptocurrency market is its high volatility due, among other things, to a strong susceptibility to the news background. Today there is an increased interest in cryptocurrencies from the media. The appearance of any news about cryptocurrencies on popular information resources is almost immediately reflected in the price of a particular cryptocurrency.

For example, when the news about the legalization of exchanges trading bitcoin in Japan appeared, its rate immediately increased by \$100 (Global Legal Research Center, 2018). Therefore, it can be said that market risk in cryptoeconomics is subject to the influence of corrective information risk. According to the proposed concept, which is currently being developed, information risk is considered a complex risk consisting of technical and qualitative components. The technical component of information risk includes the risk

of IT/IS (information technology and information systems) and the risk of breach of information security (information security). The qualitative component of information risk includes the risk of dissemination of information that is dangerous for the owner of the IA (information asset) and the risk of deterioration in the quality of the IA. Thus, when trading cryptocurrencies, it is important to take into account the qualitative component of information risk, i.e., the risk of dissemination of information that is dangerous for the owner of the information asset.

The third type of risk is operational risk. Since the subjects of cryptoeconomics operate in a high-tech environment, their operational risks increase many times over. The increase in operational risks is due to the fact that the subject of crypto-economics can simultaneously participate in several high-risk processes: be an issuer of a cryptocurrency (involved in the ICO mechanism), be a member of the financial information exchange system (involved in mining), use the services of a depository (store currency in bitcoin wallets), and, finally, to trade cryptocurrency on a specialized exchange.

Operational risk in cryptoeconomics, as mentioned above, is significantly affected by the following components of corrective information risk: information technology/information systems (IT/IS) risk and information security (IS) risk (Coeure, 2018).

Let us analyze the possible impact of IT/IS risk. This risk arises in the settlement system based on blockchain technology. One of the main criteria for assessing the possibility of successful user participation in mining is the 'difficulty' of mining cryptocurrency. "Difficulty" is a unit of measurement that indicates how difficult it is to find a block that will be below the system's suggested target. For finding a block, the user receives his reward, proportional to the total contribution to the search for the block. Thus, an additional emission of cryptocurrency takes place. The complexity of computing increases as the blockchain is mined, and the system requirements for hardware are continuously increasing.

At the same time, the load on the electrical networks increases since more and more energy is required, the costs of the miner for the maintenance of

hardware grow, and there is a need for additional investments for the modernization (upgrade) of this equipment. Ultimately, a user (or many users) may find mining unprofitable themselves and stop providing their computing power, and this may lead to network outages (Hermans *et al.* 2022). By analogy with "bankrun", one can talk about the possibility of "minersrun", i.e., mass withdrawal of computing power by users from the blockchain system, which can lead to the collapse of the system.

Another possible manifestation of IT/IS risk can be the so-called hard fork of cryptocurrencies, an irreversible protocol change, and a fork of the existing blockchain system in two parts (Hermans *et al.* 2022). Usually, hard-forks supporters are motivated by a desire to modify the cryptocurrency network, fix some of its flaws, or resolve legal issues. The most famous hard forks in the history of cryptocurrencies are the hardfork of the Ethereum network in July 2016, when the network split into Ethereum and Ethereum Classic, and the hardfork of the Bitcoin network in August 2017, which led to the emergence of a new cryptocurrency Bitcoin Cash (Voscuil, 2020). In the case of Ethereum, the hardfork was driven by the aftermath of a network breach by hackers and the theft of about \$50 million worth of cryptocurrency (Voshmgir, 2023). The developers of Ethereum managed to protect the funds of network users and ensure compliance with the principles of cryptocurrency decentralization. Hardfork of the Bitcoin network, according to the official version, was made to eliminate errors in the system, raise throughput, and increase the block capacity (Voshmgir, 2023). At the same time, the danger of hardfork is that cryptocurrency exchanges may not support the hard fork of a particular currency. Then, the funds can be blocked by the exchange and become inaccessible to users.

Another risk associated with a hard fork is the so-called replay or erasure attacks, in which the cracker can use his previously spent money a second time (return or spend it again). For Bitcoin Cash transactions, the new SIGHASH_FORKID transaction signature will be used, which should prevent the repetition of transactions in the old Bitcoin and vice versa (Caliskan, 2023).

Thus, we approached the topic of intentional violation of information security. The risk of violation of information security can manifest itself

in the form of hacker attacks on cryptocurrency exchanges and Bitcoin wallets of users. There is a possibility of an attack on the entire network of a particular cryptocurrency, the so-called “Attack of 51%”, which was first described by the alleged creator of Bitcoin Satoshi Nakamoto. Whoever has more computing power than the rest of the cryptocurrency network (in fact, the majority shareholder) can single-handedly decide which transactions will be accepted and which will be rejected. At the same time, an attacker can rewrite the entire history of block generation, starting from some point in the past, and take possession of user funds (Nova, 2021).

In addition to the above risks, a significant threat to the crypto economy is its uncertain legal status in the world. Most countries do not recognize the legality of the use of cryptocurrencies and crypto-economy infrastructure. The governments of the countries of the world are just beginning to create a regulatory framework for the regulation of cryptocurrencies. This issue remains open and needs to be resolved as soon as possible.

The United States was one of the first countries to think about the need to monitor the new market and identify public risks of cryptocurrency turnover while recognizing the prospects of this new market for the development of the country's economy. In 2013, the US General Accounting Office asked the IRS to clarify how cryptocurrencies are taxed. The main concern at that time, which served as the basis for the request, was the risk of erosion of the tax base. In 2014, the request was granted, and the US tax Department issued a letter with clarifications on the procedure for taxing cryptocurrencies (Brummer, 2019). The letter, in particular, acknowledged that cryptocurrency can be used to pay for goods and services, as well as for investments. A definition of virtual currencies was given, to which the IRS includes cryptocurrencies: “A digital representation of value that can be sold digitally and act as a medium of exchange, a unit of account or storing of value” (Brummer, 2019).

In 2012, the European Central Bank stated in an analytical report that at the moment, virtual currencies are not yet important enough to develop special regulations for them. In 2013, the European Banking Supervisory Authority already noted that there are risks associated with the use of

cryptocurrencies, since the state does not regulate them. In addition, the regulator appealed to the European Commission, reporting the need to take measures to prevent the use of cryptocurrencies for money laundering and terrorist financing. Europol made a similar statement in 2014. The European Commission agreed with these proposals and by February 2016, prepared draft amendments to the Directive on the regulation of risks related to money laundering and terrorist financing (adopted in 2018). In accordance with the draft directive, the concept of “cryptocurrency” is included in the concept of “virtual currency” as a special case and means “a digital representation of value that can be transferred, stored or sold in digital form, accepted by individuals or legal entities as a medium of exchange, but does not have legal tender status” (Girasa, 2022).

Thus, from 2013 to 2016, the United States and the EU countries gradually formed the regulation of the circulation of cryptocurrencies. None of the countries deny the possibility of using cryptocurrencies as a means of payment, as well as an investment tool. The regulation aims to reduce public risks such as tax base erosion and money laundering. Countries do not adopt specific legislation on these issues (except for EU directives), but develop detailed recommendations on how to apply existing legislation.

The German Ministry of Finance became concerned about the status of the main currency of the digital world, bitcoin in 2013, decisively legalizing an alternative digital currency. Since then, cryptocurrencies have been absolutely legal in Germany. In 2020, in accordance with German Law, all banks in the country received the right not only to store cryptocurrencies but also to make active transactions with them in the financial markets. Volksbank and Raiffeisenbank are debugging their services for buying and selling digital money. Fidor Bank AG has already reported on the integration of bitcoin payments with its payment system. Bankhaus von der Heydt is actively working on the development of its stablecoin, and its competitor Hauck & Aufhäuser Privatbankiers, has gone even further and is thinking about creating a whole cryptocurrency fund.

One can also distinguish three approaches to risk management in the field of combating money

laundering (AML) and the financing of terrorism (CFT) (AML/CFT) in international practice. The first approach is to introduce changes directly into the national AML/CFT law and establish crypto exchanges and other professional participants as an object of regulation. The second approach provides for classifying crypto exchanges and other professional participants as already existing participants in the financial market (banks, non-banking institutions, etc.), which are already subject to the AML/CFT requirement. Finally, a small number of countries have taken the path of developing independent legislation for new market participants subject to AML/CFT requirements.

For example, the Isle of Man took the first option and updated its AML/CFT legislation. In accordance with the new edition of the 2008 Proceeds of Crime Law, persons carrying out activities with cryptocurrencies are subject to AML/CFT. They must identify their clients and report to the Financial Intelligence Unit (FIU). Interestingly, ICO projects are now also subject to the requirements of this Law. For example, the Adelphoi project registered on the territory of the Isle of Man, carried out the identification of buyers of project tokens. The EU has now put forward a similar draft law change. Amendments to the AML/CFT Directive establish that persons carrying out exchange transactions between virtual currencies and fiat currencies, as well as persons providing services for the storage and transfer of virtual currency, are subject to the requirements of AML/CFT legislation and must identify their customers.

The second way, which is to extend the AML/CFT requirements to crypto exchanges and other professional participants by classifying them as institutions providing financial services, was used primarily by the United States. In particular, the US FIU recognized the activities of a number of cryptoeconomic entities (exchangers, crypto exchanges) as the activities of a financial institution within the meaning of the Bank Secrecy Law. Such institutions are subject to the requirements of AML/CFT legislation, i.e., institutions must identify their customers and provide information to the supervisory authority. However, in the United States, such institutions are required to have a financial services license.

It is interesting to note that, in accordance with the current version of the Law, the requirement to obtain a license also applies to foreign crypto exchanges and other professional participants in the financial market if such persons provide services to US residents. Foreign entrepreneurs must appoint a representative in the United States who will report to the US FIU on the activities of the company. It is worth noting that in the United States, the investigation into the BTC-E exchange on suspicion of money laundering, launched in mid-2017, was based on the fact that the BTC-E was a financial institution not registered in the United States but providing services to US residents and, accordingly, subject to under US law.

It is noteworthy that in the United States, the legislation on financial institutions also applies to participants who have organized a platform for the exchange of cryptocurrencies. At the same time, in the UK, by virtue of the Payment Services Act 2009, the requirements to register as a financial institution do not apply to those entities that exchange one cryptocurrency for another and do not work with fiat currency. So, for example, the EXMO crypto exchange, registered in the UK, did not receive permission from the financial supervisory authority, as it allows depositing fiat funds to the user's account through intermediaries that have the appropriate permission (for example, OKRLU, which is registered in the UK), despite the fact that both the EXMO and the OCRLU comply with the requirements of the AML/CFT legislation of the country.

The need to extend the existing financial legislation to new participants is also recognized in a number of European countries, for example, the already mentioned Germany, and Switzerland. Thus, the activities of a crypto-exchange in Switzerland are subject to the Banking Law of 1934 and require a banking license. However, in both Germany and Switzerland, the Law applies extraterritorially; to provide services to persons in Germany or Switzerland, one will need to obtain appropriate permits (licenses) from regulators, even if the exchange is registered in a third country. At the same time, the implementation of intermediary activities for the acceptance of cryptocurrencies as payment for goods or services and their conversion into fiat funds will not require a banking license.

These institutions will only need to obtain an AML/CFT license from the regulator. Such a license, for example, was obtained by the Payment21 payment system (Voshmgir, 2023).

The third way to reduce AML/CFT risks in countries is to create separate legislation for new market participants that are subject to AML/CFT requirements. Japan has taken this path today, introducing a new entity into the Payment Services Law a virtual exchange. In accordance with the Law, such a participant carries out activities for the purchase or sale of virtual currency, related intermediary, brokerage or agency services, services for managing users' money or virtual currency, and must obtain a permit (license) to conduct activities. At the same time, the requirement to obtain a permit (license) also applies to foreign exchanges that provide services to persons in Japan.

Thus, in international practice, at least three approaches have been developed for the possible regulation of crypto exchanges and other professional market participants. While in the first case, no additional requirements are imposed on market entities, except for compliance with AML/CFT legislation, in the second and third cases, market entities must obtain additional permits (licenses) as participants in the financial market. At the same time, the legislation of countries often has an extraterritorial character, i.e., the company must obtain a permit (license) not only where it is registered but also in the countries where it provides services.

Countries level the risks of non-payment of taxes by adopting explanatory recommendations on the procedure for taxing certain transactions with cryptocurrencies issued by the tax authorities of Canada, Great Britain, the USA, Japan, etc. The explanations allow answering the following questions: is it necessary to pay VAT when exchanging cryptocurrencies for fiat currency and vice versa (in the EU countries and Japan no); how the taxation of the activities of miners is carried out (in the UK, the receipt of cryptocurrency from mining activities is taken into account as a person's income); what direct taxes one has to pay when receiving income from the sale of cryptocurrency (USA, UK, Latvia, etc. personal income tax or corporate income tax). In addition, some countries are making changes to tax laws and stimulating

the development of the market. In Japan, for example, the value-added tax has been abolished when exchanging crypto-currency for fiat and vice versa. Together with the fact that the country has adopted legislation recognizing cryptocurrency as one of the ways to pay for goods and services, this creates conditions for the rapid development of the market. Today, the Japanese cryptocurrency market is one of the largest in the world.

In the context of management accounting, the disadvantages of cryptocurrency include the following negative points:

- ♦ Difficulty in controlling transfers. Banks and other supervisory and oversight bodies cannot control operations for the issuance and movement of cryptocurrency.
- ♦ Risk of ban. Government structures are wary of cryptocurrencies. Many countries still have introduced restrictions on its use, and fines can be imposed on violators.
- ♦ There is no possibility to cancel a payment.
- ♦ Volatility. Cryptocurrency is unpredictable, as it depends on current demand, which, in turn, may change as a result of changes in legislation and other factors. For this reason, there are fluctuations in the price of virtual money.
- ♦ Danger of loss. The "key" for access to electronic money is a special password. If to lose it, the crypto coins in the wallet become inaccessible.
- ♦ No guarantees. Each user is personally responsible for their savings. There are no regulatory mechanisms here, so in case of theft, it will not be possible to prove anything and return the money.
- ♦ There is no common organizer of trade, which reduces the credibility of the cryptocurrency.
- ♦ Cryptocurrency is not backed by anything.
- ♦ Insufficient security of cryptocurrency safety.

From a financial reporting point of view, accounting for cryptocurrencies is complex. Cryptocurrencies have various complex characteristics, and price movements tend to be erratic.

Despite their name, it would be a mistake to assume that cryptocurrencies should be counted as cash. This is because the Standard set out in IAS 7 and IAS 32 implies that cryptocurrencies

are not equivalent to cash, especially given that cryptocurrencies are still far from widespread adoption in global trade. However, these are early days and firms will become more familiar with the cryptocurrency market. At the same time, the basic principles of digital asset valuation remain the same. In 2019, the International Financial Reporting Standards Board (IASB) concluded that cryptocurrencies meet the definition of an intangible asset in IAS 38, and if held for sale in the ordinary course of business, it falls within the scope of IAS 2 “Stocks”, as it was mentioned above.

Both the IASB and the Financial Reporting Standards Board (FASB), which governs generally accepted accounting standards in the US, agreed that there is currently no clear path to a one-size-fits-all solution to this issue. Instead, accountants need to consider the nature and financial impact of digital assets to determine how they should be accounted for.

The auditors are responsible for providing sufficient evidence relating to the board’s assertions regarding the fairness of the financial statements. But because of the subtle concept of regional differences, the way forward resources are valued is clearly unique.

DISCUSSION

Understanding the ability of cryptocurrencies to replace current fiat money requires studying how cryptocurrencies can perform the basic functions of money: being a measure of value, a store of value, and a medium of exchange. Cryptocurrencies are a form of money that was not previously available as a specific combination of monetary characteristics. In particular, cryptocurrencies are:

- ♦ *Private money*: Unlike traditional private money (such as bank receipts), cryptocurrencies are not a liability and cannot be redeemed. In this sense, cryptocurrencies partially embody the ideas of Friedrich von Hayek about private money the state does not control their emission, and competition between various cryptocurrencies is already at a relatively high level (Hermans *et al.* 2022). The algorithmic emission of cryptocurrencies also makes their monetary policy transparent and predictable this characteristic can be perceived as both an advantage and a disadvantage at the same time since an algorithmically specified emission

leaves practically no possibility of leveling economic shocks.

- ♦ *Digital money*: This characteristic is also not new in the money market since cryptocurrencies are inherently similar to electronic money issued by payment systems such as PayPal or WebMoney. However, the lack of binding to any of the jurisdictions allows the creation a truly global and easily accessible currency that could contribute to globalization and the development of international trade and is already often used for international payments.
- ♦ *Decentralized settlements*: Blockchain technology allows cryptocurrency users to conduct transactions with each other directly without involving intermediaries. This property ensures the anonymity of transactions, the confidentiality of economic agents, as well as the security of stored data. On the other hand, the absence of supervisory authorities in the network can lead to transactions related to illegal or shadow activities.

Historically, the success of a currency has been characterized by two key features: the stability of the currency and the extensive network of its users, which are based on different forms of social contract and are closely intertwined. The stability of a currency, in addition to influencing its use as a store of value, significantly affects its likelihood of being used as a measure of value and a medium of exchange. Ultimately, the success of any given money can be correlated with the strength of the institutional arrangements and rules that support it, and with the extent to which it provides stable and predictable purchasing power and a user network. The rules underlying the management of official currencies are an integral part of a more stringent system of rules and laws governing all economic activities of the state and directly affect the quality of the currency. At present, central banks are strict in ensuring that the currency they issue performs well the three main functions of money. The state played a crucial role in the process of formation and development of fiat money systems by resorting to the normative regulation of exchange processes in the economy.

Many experts agree that the currently existing cryptocurrencies act rather as financial assets than

as currencies. They can be viewed as speculative assets that are likely to generate income only as a result of capital gains.

The first and most important reason for this is the inherent volatility of cryptocurrencies, which is a side effect of the functioning of their emission algorithms. So, in the case of Bitcoin, the maximum emission value is fixed at a limit of 21 million BTC, and the emission itself follows a predictable path, almost precisely forecasted depending on the level of the total network power. It is important to note that the limited supply does not match the current level of demand, which entails strong volatility. The inelastic supply curve of bitcoin, written in the program code of the cryptocurrency, leads to the volatility of the currency, which in turn does not allow it to act as a good store of value. Moreover, this fact also holds back the pace of cryptocurrency adoption and its use as a medium of exchange and a measure of value. The above two problems reinforce each other because the high volatility of today's cryptocurrencies is also partly the result of their limited use and the fact that the share of speculators in the total number of users is quite high (Baur *et al.* 2018).

Tobias Adrian *et al.* (2022) warn that “there's a growing interconnectedness between virtual assets and financial markets. Crypto Prices Move More in Sync With Stocks, Posing New Risks. Crypto assets such as Bitcoin have matured from an obscure asset class with few users to an integral part of the digital asset revolution, raising financial stability concerns”. Fig. 1 below shows the correlation between Bitcoin returns and S&P 500 index.

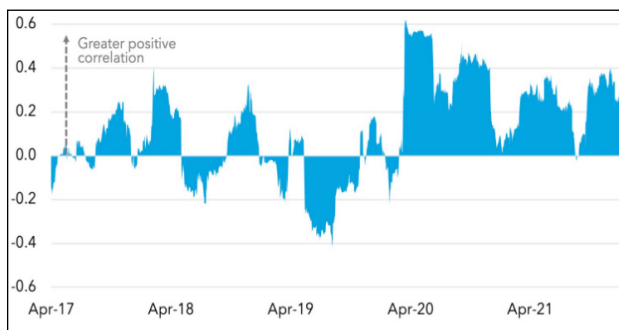


Fig. 1: Correlation between Bitcoin returns and S&P 500 index (Adrian *et al.* 2022).

“Stronger correlations suggest that Bitcoin has been acting as a risky asset. Its correlation with stocks has turned higher than that between stocks

and other assets such as gold, investment grade bonds, and major currencies, pointing to limited risk diversification benefits in contrast to what was initially perceived” – Adrian *et al.* (2022).

The global nature of major cryptocurrencies can also be a sound issue: price stability means that the basket of goods and services included in a particular jurisdiction's CPI is price stable. However the currently existing cryptocurrencies are global and are not tied to a specific country or region. From a monetary policy perspective, the global nature of cryptocurrencies is unlikely to be optimal for regulation, as it will lead to an inability to adjust exchange rates within a local region. Thus, the result will be a crypto-monetary policy (i.e., regulation of issuance algorithms at the program level) that will be consistently too tight for some regions and too loose for others.

At the moment, cryptocurrencies exist and operate along with official currencies. Their current volumes of use are small and do not globally challenge the position of official money as the main currency. However as algorithms improve the volatility limit of cryptocurrencies, their popularity and usage may increase. This will lead to closer coexistence with other official currencies.

In particular, non-state currencies can be used if official currencies can no longer provide price stability, i.e., will lose their function as a medium of exchange when the central bank reliably guarantees the real value of money a similar situation can now be observed in Venezuela, Argentina, Turkey, etc. Thus, due to the unstable economic situation, high inflation, and international sanctions in these countries, the use of cryptocurrencies there significantly increased.

Central banks have an advantage as they are the ones who choose a particular government monetary policy strategy and can potentially prevent cryptocurrencies from being valued as a medium of exchange (but they could still be valued in other ways, such as purely speculative assets). From another point of view, instead of being a threat, the coexistence of fiat money and cryptocurrencies can have a positive effect, and cryptocurrencies will act as a discipline tool for central banks. This is a partial implementation of the ideas of Hayek, who advocated breaking the

state monopoly on money as a way to ensure the stability of the official currency (Werbach, 2018).

However, from a more practical perspective, central banks may face some risks due to the emergence of cryptocurrencies as relevant mediums of exchange with stable purchasing power. First, the extent to which economic agents replace cash and bank deposits with cryptocurrencies will determine the effectiveness of monetary policy. The mass replacement of bank deposits, in particular, would lead to a decrease in control over monetary indicators due to the reduction in the amount of money in the economy. Second, the shrinking role of central bank money creates a possible financial risk in the form of reduced revenues. The answer could be a revision of tax rates, which, however, would hurt economic growth. Nevertheless, such risks appear to be exaggerated, given that seigniorage revenues represent a negligible share of total government revenue.

Last but probably most important, the threat does not come from the potential use of cryptocurrencies as money but from their attractiveness as investment assets. Like any speculative investment, an investment made in anticipation of a return on capital gains, cryptocurrencies will be subject to the formation of “bubbles”. The collapse of the cryptocurrency bubble could affect the broader financial environment if households, corporations, and financial institutions invest heavily in these assets.

Bitcoin is a virtual currency that is not backed by any real value, which is considered the main problem of its implementation and widespread use as a currency. In the meantime, bitcoin is mainly accepted only as a financial instrument, on the fluctuations of the exchange rate of which market participants are trying to earn money, but with its insecurity, it looks more like a financial pyramid and a soap bubble. Moreover, the threat of attacks with the already mentioned capture of 51% of the blocks actually means the monopolization of the entire system and its capture, which fraudsters can exploit. If an attacker owns more than 51% of the power, he will also be able to create an alternative chain, which will turn into the main one. This situation is reminiscent of voting at a shareholder meeting, when one of the owners has a controlling

stake in his hands, blocking the votes of other holders (Armstrong *et al.* 2019).

While many large merchants such as Microsoft and Dell are willing to accept cryptocurrencies for payment, most of them use an intermediary (such as Coinbase) that provides instant and risk-free conversion to the currency of the respective country. Thus, cryptocurrencies have not yet been reflected in the accounting of large retailers. However, accounting for cryptocurrencies is important for hundreds of companies whose activities are directly related to them. This includes the creation of electronic wallets, the provision of trading platforms, money transfer services, and, of course, the mining of cryptocurrencies. The latter type of activity has become corporate in color since its implementation requires increasingly more computing power, which is not affordable and available to private individuals.

Currently, many companies working with cryptocurrencies are funded by private investors and do not publish their financial statements in the public domain. However, given the rapid growth in the capitalization of cryptocurrencies, the IPOs of these companies or their takeover by major players are inevitable in the near future. Thus, uniformity in approaches to accounting for cryptocurrencies will soon become relevant for many companies. In addition, the investment attractiveness of cryptocurrencies means that they can appear on the balance sheets of companies interested in high-risk, but high-yield investments. In turn, this determines the need to introduce appropriate changes/additions to the practices and processes of management accounting.

In this context, it is expedient to address IMA (Institute of Management Accountants) report of 2023. It states that on public blockchains, all transactions can be seen by anyone. Given that management accountants are often dealing with internal, proprietary information, the use of a private blockchain may be preferred given the industry. Regulations around data privacy may also impact compliance considerations. Again, management accountants can help their organizations assess their ethical duty to balance transparency and privacy and then decide which option (either public or private, or a hybrid) is appropriate for their organizations. “There’s a lot

of potential applications management accountants would benefit from knowing because they may be able to help build those types of systems and help the trust equation work more efficiently for their companies" (IMA, 2023, p.19).

"When transactions take place without a third party, customers have no one to whom they can appeal for help. Management accountants must understand the related risks and be able to explain the implications to the management team and the board of directors, and ensure everyone is fully on board. Any external auditor should also be informed. In some cases, organizations should consider obtaining informed consent from anyone who may be impacted" (IMA, 2023, p.19).

CONCLUSION

In conclusion, it should be recognized that the development of the use of cryptocurrencies and other crypto assets will grow everywhere in the world and replace outdated social processes. Regulators must be prepared for such developments and formulate a position based on the principle of free entrepreneurship and a risk-based approach to protecting public values.

The crypto market can be volatile and unpredictable, and the recent downturn is a reminder to investors that crypto assets come with increased risk and unpredictability, especially during times of monetary and political instability. The instability of the bitcoin exchange rate is obvious, which cannot but speak of the instability of this means of payment overall. Currently, there are about 15.5 million bitcoins in circulation. Bitcoin transactions barely exceed \$300 million, while the SWIFT system sustains \$6 trillion daily (Caliskan, 2023). These figures indicate the insignificance of the bitcoin market, but in practice, they are relevant in modern conditions of research into those potential areas of use of blockchain technology and, most importantly, the possibility of their application in modern domestic countries-based conditions. Directions of research of such possibilities depend on the attitude of the state to this problem. We are confident that the state should not prohibit (this is the easiest way) cryptocurrency, and not let this market go into the shadow sector, but quickly find a way to use it reasonably and effectively, including for social benefits. Here we must specifically understand that nothing can be

solved by a prohibition, but it is necessary to legally ensure the implementation of this innovation in the financial market and design effective risk mitigation mechanisms. If the moment has really come for emerging a functional, transparent, low-cost, publicly available monetary instrument that unites the whole world, then the state should make every effort to legally comprehend and technically support the activity of this financial market instrument with the extraction of maximum benefits and minimization of risks, the main ones of which are described in this article.

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