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MANAGEMENT OF FINANCIAL RISKS ARISING FROM THE USE OF VIRTUAL CURRENCY BY ENTERPRISES: AN APPROACH TO ASSESSMENT

ABSTRACT

Virtual currency is a consequence of deep digitalization, which in turn has significantly affected the market economy and introduced new types of payments. In essence, it is a kind of digital currency that is used and stored exclusively in electronic form. This includes various types, but the most famous is of course Bitcoin. This has led to the fact that the private sector has also begun to use it, including enterprises. Virtual currencies continue to develop and gain popularity but are also accompanied by issues of regulation, security and volatility. One of the most significant problems is the issue of financial risks that arise when using it. Of course, it is IT companies that most often use virtual currencies today to develop and implement new digital products and services, for example, in the field of blockchain technologies or digital payment systems. Therefore, they will be the object of our research. The purpose of the article is to present our own method of assessing financial risks and justify its effectiveness in comparison with the already established ones. At the same time, the proposed approach takes into account the specifics of the use of virtual currency by enterprises. As a result, a correlation-regression analysis of the influence of individual factors on the level of generalizing indicators of retrospective assessment of the riskiness of using virtual currency for the enterprises we selected is presented. Using the data presented in the article, management can predict changes in generalizing indicators of retrospective assessment of the riskiness of using virtual currency depending on changes in the relevant indicators-factors.

Keywords: finance, financial risks, currency, virtual currency, business operations, management, risk assessment, virtual assets

JEL Classification: G32, G41, O32, L17

INTRODUCTION

Money is an integral part of the modern economy and is an important aspect of the modern world. Money is used for settlements between counterparties, is an important tool for investing in various assets, and is also the main means of financing for businesses and governments. They can also be used to make payments, pay taxes and other mandatory expenses. The emergence of innovative new forms of money leads to the search for new approaches to their classification, characteristics and accounting. Ukraine, like many other countries, is in the process of forming a market for electronic and digital money. Accordingly, the rules and regulations in this sector are still developing. But already today, enterprises are beginning to actively use virtual currency. Virtual currency for enterprises can make a real revolution in the global economy. It has already become a global phenomenon and is spreading at a fairly rapid pace: the purchase of Bitcoin, the transition of companies to digital contracts (smart contracts) based on blockchain technology and support at the local level in several countries of the world. However, for Bitcoin to become money in the full sense of the word, a decision by the government of a particular country is needed. It is quite possible that over time, national currencies will transition from paper to virtual, just as paper money once replaced gold and silver. The world has long been discussing the abandonment of cash in order to combat corruption, the shadow economy and prohibited activities. The introduction of blockchain technology will make it possible to track the chain of transactions and then

all the money will come to light, violators can be easily punished, and fraud will be much more difficult. Central banks should design the national cryptocurrency so that its emission remains in their hands, and then they would retain control of money circulation.

In the conditions of active development of globalization processes, virtualization of society and progressive development of new technologies and innovations, the intensive development of information and network economies on a global scale is constantly growing. These changes generate structural changes in economic theory and pose new challenges to scientists from all over the world. Every year, developers offer the market new payment systems, within which new types of currencies are freely convertible, which determines the development of the circulation of virtual currency. In the process of global development of technologies and innovations, the gradual modernization of all economic processes at the beginning of the 20th century, in parallel with the real economy, the virtual economy, the basis of which is the circulation of digital currency, is gaining wide development. The virtual currency has both a number of advantages and disadvantages, the main of which are opacity and wide opportunities for laundering money obtained through criminal means. We consider its decentralization to be the main point of discussion in the issue of control and regulation of the circulation of virtual currency in the world. The advantage of decentralization is that it is easier to implement certain standards for the issuance of this type of currency and its distribution at the local level. You get secure decentralized production, exchange of issued currency for real, as well as no costs for printing banknotes and their paper protection.

With the development of globalization, the spread of IT technologies and general computerization, the financial systems of individual countries are improving and progressing. This process contributes to the emergence of new financial institutions, tools and forms of interaction between people. Thus, an alternative monetary circulation has appeared, which includes the emission and use as a settlement instrument of additional banknotes, both authorized and unauthorized by public authorities of the state, which are in circulation on a par with legal tender.

It is IT companies that often implement virtual currency to optimize payments, create their own tokenized ecosystems and attract new investments, as this allows them to quickly conduct cross-border transactions, simplify settlements with third-party counterparties and offer users additional blockchain-based services, integrate technologies into their own software products and platforms.

1. Exchange rate fluctuations of virtual currency can cause the loss of part of the assets.
2. The lack of proper regulation increases the risk of fraud and dishonest transactions.
3. Storage of cryptographic keys requires compliance with enhanced security rules, otherwise cyberattacks are possible.
4. Legal restrictions or prohibitions can complicate or make it impossible to use virtual currency.
5. In the event of technical failures or shortcomings in the blockchain infrastructure, there is a risk of losing access to funds.

LITERATURE REVIEW

The growing popularity of Bitcoin and the rapidly decreasing role of cash are forcing financiers and bankers to consider the possibility of issuing national virtual money. On the one hand, this will reduce costs in the existing payment system, and the government will strengthen control over money circulation, but on the other hand, it may lead to problems related to ensuring security and confidentiality. Currently, no state has issued a digital (virtual) version of its national currency, but due to the rapid development of the digital economy, government agencies are beginning to realize the inevitability of the spread of the digital payment system. However, this does not prevent businesses from actively using them to implement their activities, even despite a number of financial and other risks (Arias-Oliva, et al., 2019).

To begin with, it is worth paying attention to the correct statement of Scott, B. (2016) and Bergsli, (2022) that a significant place in the commodity economy has belonged to money for many centuries. The relations that arise regarding its issuance and use constitute the monetary system. Monetary systems have constantly developed, interacting with the political and economic environment that surrounded them. Events in the monetary sector at the beginning of the 21st century indicate that the evolution of monetary systems continues, as new signs and features of their functioning appear. In addition, with the advent of electronic money and cryptocurrencies, central banks are again losing their monopoly on monetary emissions. In view of this, the study of the evolution of the monetary system is an important direction in economic science. Thus, the formation of digital currency was carried out in stages. Thanks to the development of network software and hardware, its new virtual forms continue to appear (Al-mansour, 2020).

At the same time, as Dubyna, (2023) and Handoko, (2024) note, the very mass spread of monetary transactions using virtual currency, despite certain warnings from regulatory authorities, requires a more thorough study of the possibilities of functioning of various electronic payment instruments in the country's internal monetary system. This, in turn, generates certain financial risks. For example, we agree with the opinion of Abubakre, (2022) and He, (2016) that enterprises that use various types of digital virtual currencies often do not understand the complexity of their legal status. Thus, non-state emissions of monetary units do not provide for the exchange of digital currencies among themselves, which, first of all, contradicts the principle of recognizing a payment instrument as a currency. According to Gollapalli, (2023), the most favourable financial environment for the use of cryptocurrency is in Germany. However, even there, there are gaps in the management of emerging financial risks. All this significantly updates the issue of financial risk management and their assessment, especially for those enterprises that actively use virtual currency in their activities.

According to Zheliuk (2016), the introduction of virtual currencies has a number of advantages. However, this type of monetary instrument requires a respectful attitude from the regulator and users, especially in the field of risk management, system stability, interaction with fiat money, as well as use for cross-border transactions. Virtual currency technology ensures full traceability of the movement of funds provided from budgets along the economic and production chains of goods, works and services, which is critical to ensure control and prevent potential offences by unscrupulous recipients of funds. Despite this, it is necessary to note the various aspects of virtual currency, namely what danger and threat it can carry from a legal point of view. As S. Volosovych (2018) rightly notes, all settlements through virtual currency carry direct legal financial and economic risks, the reason this kind of currency is simply (especially 5-10 years ago) attractive for committing illegal actions: money laundering, i.e. Doronin (2017) correctly notes that the basic principles of economic theory link the nature of money with value. Traditional types of money (paper credit or fiduciary, fiat) are closely linked to commodity value through the credit system. So-called virtual money is not tied to the value of goods. There was an attempt to establish a system of backing cryptocurrency with gold, but it failed. In this regard, experts have doubts about the equivalence of the concept of cryptocurrency to the concept of money. The future of virtual currencies is a question that worries many financial analysts, lawyers and market participants. The change in the global economy is an obvious consequence of the progress of the digital market. Blockchain allows humanity to obtain innovative products that give birth to new forms of business existence (Merinova, 2021).

The issue of virtual currency in business became significantly more active during the pandemic (Nikonenko, et al. 2021), when the demand for remote work increased dramatically, practically in a matter of days, and with it, the introduction of enhanced e-commerce. There was essentially a boom in the need for both cashless and digital payments. During this period, virtual currency seemed to an increasing number of enterprises as a real option for a new means of digital transaction. A significant number of enterprises, especially in the EU and the USA, saw that the COVID-19 pandemic had created new conditions in which the integration of virtual currency would become the new standard. We have: speed, efficiency and reduced costs associated with the transaction itself (commission, etc.). However, this significantly increased the number of financial risks. In general, the issue of financial risks in enterprises has significantly increased from the side of practitioners and scientists precisely during the COVID-19 pandemic. The financial risk management models in place before the COVID-19 pandemic have not proven to be as effective during it. There is an urgent need to implement new models and, along with this, build new assessment mechanisms.

AIMS AND OBJECTIVES

We aim to present and properly justify our own method of assessing financial risks and justify its effectiveness in comparison with the established ones. At the same time, the proposed approach takes into account the specifics of the use of virtual currency by enterprises. We believe that it is IT enterprises that most often use virtual currencies today to develop and implement new digital products and services, for example, in the field of blockchain technologies or digital payment systems. Therefore, it is they who will become the object of our research. We set the following tasks within the framework of this article for ourselves in order to achieve the goal:

1. To outline the key factors that affect the riskiness of using virtual currency.
2. To calculate the integral indicator of retrospective risk assessment.
3. To conduct a correlation-regression analysis to clarify the influence of individual factors on this integral indicator.
4. To demonstrate the calculations and interpret the results using the example of data from four enterprises.

METHODS

It is necessary to clearly justify the selected research methods that constitute the methodology of our article (Figure 1).

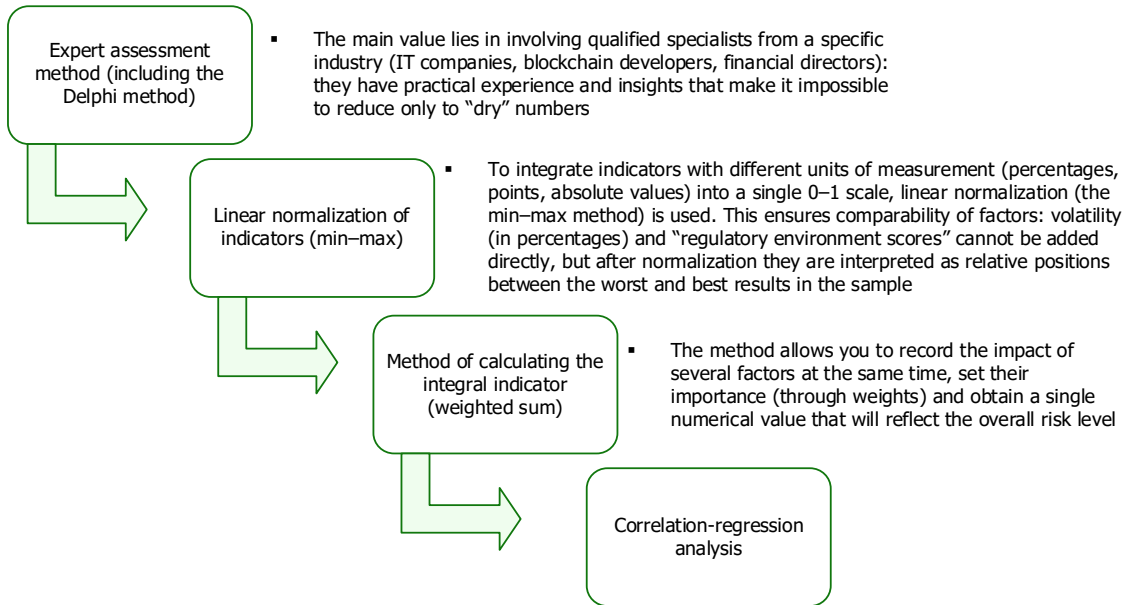


Figure 1. Justification of the methodology.

At the same time, the method of calculating the integral indicator "RI" is extremely easy to modify. You can introduce new factors or change the weights based on the results of new expert surveys, etc.

RESULTS

The legal regime of cryptocurrencies in Ukraine is based on the regulation of the cryptocurrency market. Therefore, with the adoption of the Law of Ukraine "On Virtual Assets" of February 17, 2022, Ukraine officially legalized the links with the turnover of the so-called bitcoins. However, a significant number of IT companies are still using virtual currency most actively in their activities. It should be noted that today the regulatory framework of Ukraine in the field of virtual currency use is still in the early stages of formation. A very small number of Ukrainian enterprises use virtual currency so actively that it brings them significant financial risks. There are no established regulatory mechanisms at the state level; at the micro level, there are no such volumes of transactions with virtual currency that require an appropriate response. It was also difficult to obtain a full range of information from domestic IT companies on how actively the latter use virtual currency. Along with these, Germany and Estonia already have long-term access to work with virtual currency. That is why the decision was made to demonstrate the proposed assessment methodology within these countries while maintaining the ability to extrapolate the results obtained in the future for Ukraine (Figure 2).

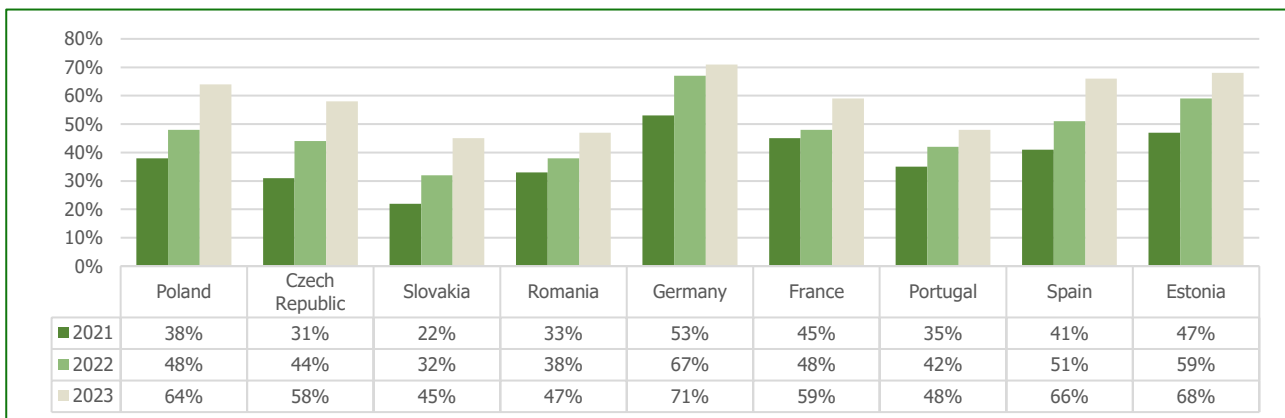


Figure 2. Share of IT companies in EU countries using virtual currency in their activities, %. (Source: Eurostat, 2024))

We believe that Germany and Estonia together form the so-called necessary contrast in the study today because they allow us to analyze the impact of different regulatory approaches, consider differences in the structure of virtual currency transactions and compare risk levels in the two EU countries. As part of the implementation of our approach, we contacted two companies in Germany: Nuri (Bitwala) and NAGA. And two companies in Estonia: CoinMetro and Kriptomat. All of them are already actively using virtual currency in their financial and economic activities.

There is a generally accepted (Lezgovko, 2007; Kaleininkaitė, 2007) indicator for assessing financial risk, namely the financial severity ratio (financial risk), which is calculated as the total sum of the enterprise's short-term and long-term liabilities to its equity (Figure 3). This ratio can also be supplemented with other indicators, such as the interest coverage ratio, which measures the enterprise's ability to generate enough income to cover interest payments on debts. We see that for the enterprises in Germany and Estonia selected by us in the article, it is low, i.e. it indicates greater financial stability and lower risk, which, according to its components, does not take into account the specifics of virtual currency. We selected four active companies in order to present an in-depth analysis and evaluation of the proposed approach. It is important to note that in the conditions of war, it was extremely difficult to find contact and agree with Ukrainian enterprises that use virtual currency and obtain from them all the data for evaluation. We had direct contact with the companies Nuri and Coinmetro. In many scientific and practical works, such a sample is called an illustrative case. Therefore, these companies are part of our illustrative case. In fact, in our case, these companies were chosen for the convenience of the sample, because they provided all the necessary information for evaluation. Also, these four companies come from two different countries and demonstrate different volumes of both transactions and different levels of maturity in the use of virtual currency.

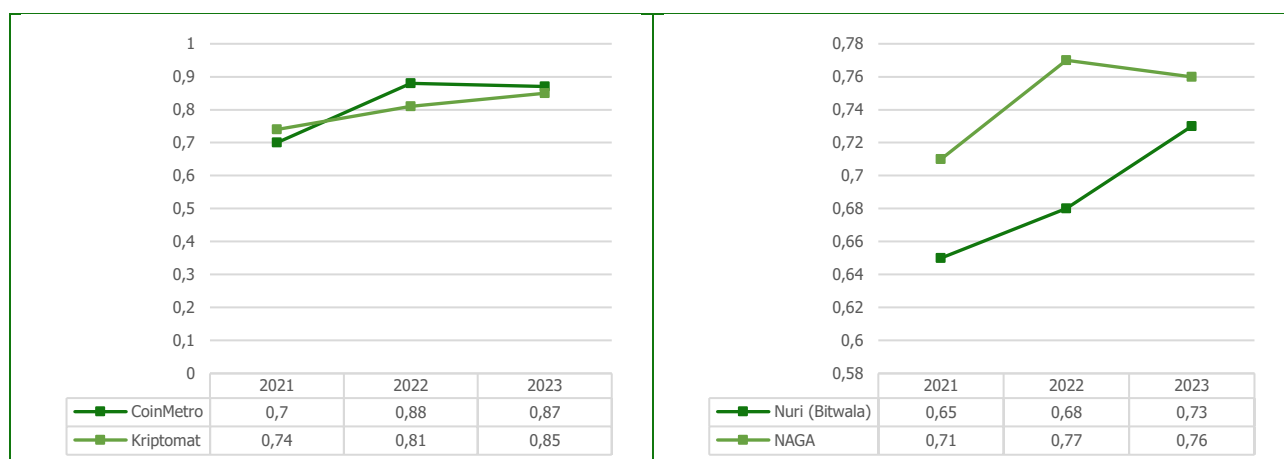


Figure 3. The financial severity ratio (financial risk).

For further convenience, we will denote Nuri (Bitwala) as enterprise «A»; CoinMetro as enterprise «B»; NAGA as enterprise «B»; Kriptomat as enterprise «D».

We have identified the following 4 factors that affect the increase/decrease of financial risks when using virtual currency:

1. Volatility (V) – volatility of the virtual currency exchange rate.
2. Regulatory Environment (R) – an index of the regulatory environment in the country where the enterprise operates.
3. Security Incidents (S) – the number of security incidents related to the use of virtual currency.
4. Liquidity/Payment Turnover (L) – the liquidity and volume of transactions of the enterprise with virtual currency.

Next, the so-called integral risk indicator will be calculated for the enterprises we have selected. It should be remembered that each factor has different units of measurement, therefore, they should be reduced to a comparable scale (0–1) by applying, for example, linear normalization, which has the following form (1):

$$X_{norm} = (X - X_{min}) / (X_{max} - X_{min}) \tag{1}$$

X_{min} and X_{max} are the minimum and maximum values among the studied sample.

Each factor has a corresponding weight, and this weight must satisfy the equality: $\sum w = 1$. With the help of experts, we distributed this weight by the following factors:

1. Volatility (V) – 0.35.
2. Regulatory Environment (R) – 0.25
3. Security Incidents (S) – 0.2
4. Liquidity/Payment Turnover (L) – 0.2

Next, the risk indicator RI (2) will be directly calculated:

$$RI = \sum_{i=1}^n w_i * X_i, norm \quad (2)$$

RI takes values from 0 to 1: 0–0.3 – low level of financial risk; 0.31–0.6 – moderate level of financial risk; 0.61–0.8 – high level of risk; 0.81–1.0 – high level of financial risk.

Table 1 shows the indicators, as well as their minimum and maximum values in the sample. It should be noted that min and max are generalized indicators based on open data from Eurostat. The following were used for this: enterprise data reports; stock exchange statistics, regulatory indices (Global Crypto Adoption Index); and Information on cyber incidents from open sources. Also, we present the results of normalization calculations.

Indicators	Min	Max	Enterprise A	Enterprise B	Enterprise C	Enterprise D	Normalization (N)			
							A	B	C	D
Volatility (V), %	20	80	70	35	65	45	$(70-20)/(80-20)=0.833$	$(35-20)/(80-20)=0.25$	$(65-20)/(80-20)=0.75$	$(45-20)/(80-20)=0.417$
Regulatory Environment (R), 0-10	2	10	5	8	6	9	$(5-2)/(10-2)=0.375$	$(8-2)/(10-2)=0.75$	$(6-2)/(10-2)=0.5$	$(9-2)/(10-2)=0.875$
Security Incidents (S), units/year	0	5	2	1	2	0	$(2-0)/(5-0)=0.4$	$(1-0)/(5-0)=0.2$	$(2-0)/(5-0)=0.4$	$(0-0)/(5-0)=0$
Liquidity/Payment Turnover (L)	5	40	25	10	30	15	$(25-5)/(40-5)=0.571$	$(10-5)/(40-5)=0.142$	$(30-5)/(40-5)=0.714$	$(15-5)/(40-5)=0.285$

Next, we proceed directly to the calculation of the integral RI indicator. Taking into account the above distribution of the weight of each indicator/factor (w), we present the calculation result in Table 2.

Enterprise	Calculation of the indicator $RI = w_v * N_v * w_r * N_r * w_s * N_s * w_l * N_l$
Enterprise A	$RI = 0.35 * 0.833 + 0.25 * 0.375 + 0.20 * 0.4 + 0.20 * 0.571 = 0.58$
Enterprise B	$RI = 0.35 * 0.25 + 0.25 * 0.75 + 0.20 * 0.2 + 0.20 * 0.14 = 0.34$
Enterprise C	$RI = 0.35 * 0.075 + 0.25 * 0.5 + 0.20 * 0.4 + 0.20 * 0.714 = 0.52$
Enterprise D	$RI = 0.35 * 0.417 + 0.25 * 0.875 + 0.20 * 0 + 0.20 * 0.285 = 0.38$

In general, the results of Table 2 indicate that the German companies we selected have a moderate level of financial risk in principle, but they still have a higher RI value (Nuri (Bitwala) has the highest RI value, mainly due to high volatility (0.833). As for Estonian companies, they have fewer cyberattacks, which ultimately allowed them to show a better RI (Table 3).

Germany		
A (Nuri)	RI=0.58	Moderate (near upper)
C (NAGA)	RI=0.52	Moderate
Estonia		
B (CoinMetro)	RI=0.34	Moderate (lower end)
D (Kriptomat)	RI=0.38	Moderate (lower end)

Next, we set ourselves the task of finding out how a change in each of the factors (V, R, S, L) affects changes in the integral RI risk indicator. We do this using correlation regression analysis. To perform multiple linear regression, we need (3):

$$RI = \beta_0 + \beta_1 \cdot N_V + \beta_2 \cdot N_R + \beta_3 \cdot N_S + \beta_4 \cdot N_L \quad (3)$$

where β are the desired coefficients of the regression model.

The β value itself is obtained by the method of least squares from the sample data of the selected enterprises. We can check the statistical significance of each β_i (by t-tests and P-value) and determine whether this factor really makes a significant contribution to the model (Table 4).

Table 4. Obtaining the regression equation.

Parametr	Rating	t	P-value
β_0	0.1	1.95	0.081
β_1	0.45	3.5	0.011
β_2	0.2	2.2	0.05
β_3	0.15	1.8	0.105
β_4	0.25	2.8	0.021

$$RI = 0,10 + 0,45 \cdot N_V + 0,20 \cdot N_R + 0,15 \cdot N_S + 0,25 \cdot N_L$$

In conclusion, we emphasize that the greatest influence (in terms of coefficient) has volatility V (0.45). This is logical since fluctuations in virtual currency rates directly affect financial risks. And even though Security Incidents (S), which has the least influence (0.15), are still a lot and significant. Although Company A has a higher share of transactions in virtual currency, Company B operates in a more favourable legal framework (R=8), there is still a need to balance the portfolio through futures, options, insurance, etc.

All calculations were carried out using correlation-regression analysis, in order to present the best approach to assessing financial risks as a replacement for the more established "financial severity ratio". We intend to show that the integrated RI indicator we have proposed can be an effective solution for taking into account the specifics of the use of virtual currency by taking into account factors such as the regulatory environment and volatility. For example, our indicator can have an impact on the financial risk management system. If volatility increases, RI approaches 0.58 - this indicates an average level of financial risk. In this case, management should make appropriate decisions: hedging strategies to mitigate exchange rate fluctuations, etc.

We believe that the application of the above-described approach to assessment may also be useful for Ukrainian enterprises with their realities (Figure 4).

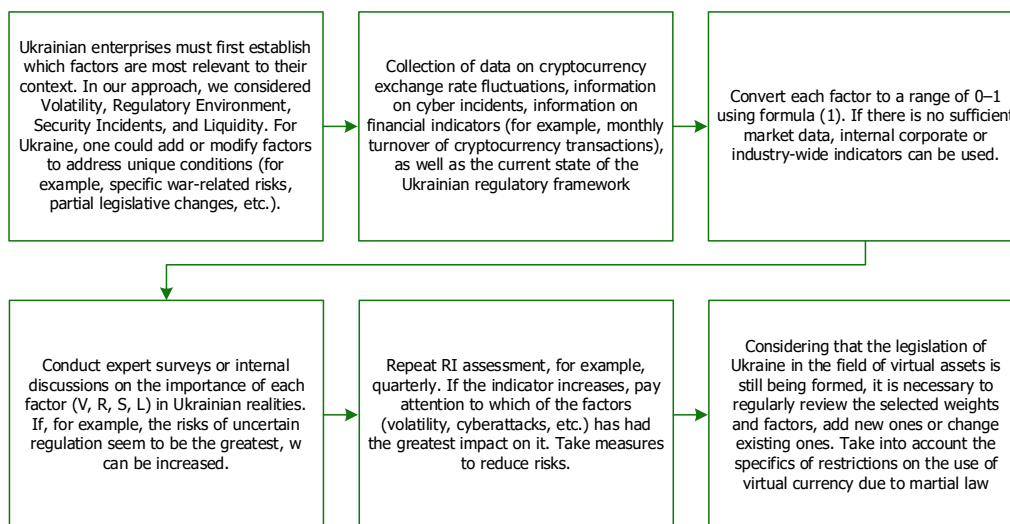


Figure 4. Step-by-step possibility of adaptation to Ukrainian enterprises.

Step-by-step detailing of the possibility of integrating the proposed approach will significantly improve the systematic assessment and control of own financial risks associated with the use of virtual currencies.

DISCUSSION

Let's form a comparative figure (Figure 5) summarizing the key elements of each reference and highlighting how our proposed approach is different or novel in comparison.

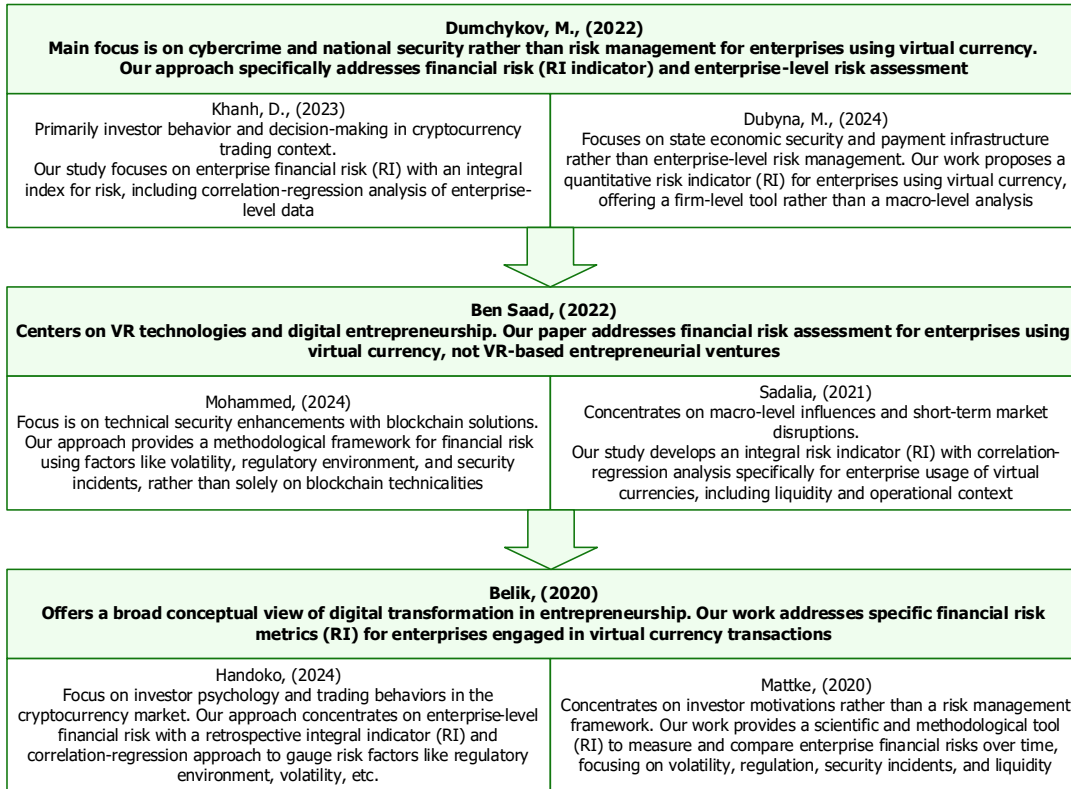


Figure 5. Compare our results.

Need to note that while most other works focus on macroeconomic, technological, or behavioural/psychological aspects of cryptocurrency, we try to focus in the operational financial risks at the more enterprise level. Think is, that more and more results seek to demonstrate evaluation methods as a whole by market, country, etc. But one can also consider virtual currency in the context of individual enterprises. Also, we try to combine critical risk factors (Volatility, Regulatory Environment, Security Incidents, and Liquidity/Payment Turnover) into a single index.

CONCLUSIONS

We proposed a scientific and methodological approach to financial risk management when using virtual currency of an enterprise. We set ourselves the task of demonstrating an approach to assessing financial risks when using virtual currency, taking into account the peculiarities of the activities of enterprises and the specifics of the virtual currencies themselves, while for this it was important to first show the ineffectiveness of the generally accepted indicator of financial risk assessment. Four operating IT enterprises that actively use virtual currency were selected and their statistical data was provided by their management. We selected 4 key factors: Volatility (V); Regulatory Environment (R); Security Incidents (S); and Liquidity/Payment Turnover (L). It should be noted that this list of factors is not exhaustive and will be expanded by us in further research. The process of forming an integral indicator of retrospective risk assessment was presented. He, in turn, laid the foundation for conducting a correlation-regression analysis, the purpose of which was to clearly and critically find out how the change in each of the factors (V, R, S, L) affects the changes in the integral risk indicator RI.

We have established that for at least one of the selected IT enterprises, with a high frequency of transactions in virtual currency, the vulnerability zone increases. Since the second of the selected enterprises operates in another country, that

is, in a more favourable legal framework, this helped to partially compensate for the higher financial risks. We have established that if you want to actively use virtual currencies, you should diversify risks and apply hedging. We believe that the proposed indicator "RI" can help enterprise management and its managers quickly assess the level of financial risk and compare several enterprises or several time periods.

Finalizing all of the above, it should be noted that the result of the correlation-regression analysis demonstrated the effectiveness of the proposed assessment approach. At the same time, a number of aspects are still unresolved and require further in-depth analysis. In particular, it will be important to form an organizational and economic mechanism for ensuring a financial risk management system for IT enterprises that actively use virtual currency within their own activities.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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УПРАВЛІННЯ ФІНАНСОВИМИ РИЗИКАМИ, ЩО ВИНИКАЮТЬ УНАСЛІДОК ВИКОРИСТАННЯ ВІРТУАЛЬНОЇ ВАЛЮТИ ПІДПРИЄМСТВАМИ: ПІДХІД ДО ОЦІНЮВАННЯ

Віртуальна валюта є наслідком поглибленої цифровізації, яка в свою чергу суттєво вплинула на ринкову економіку й принесла нові види розрахунків. По суті, це такого роду цифрова валюта, яку використовують і зберігають виключно в електронній формі. Сюди можна віднести різні види, але найбільш відомий, звичайно, Біткойн. Це призвело до того, що й приватний сектор почав її використовувати, в тому числі підприємства. Віртуальні валюти продовжують розвиватися й набувають популярності, але цей процес також супроводжується питаннями щодо регуляції, безпеки та волатильності. Однією з найбільш суттєвих проблем є питання фінансових ризиків, які виникають при використанні цифрових валют. Звичайно, саме підприємств ІТ-царини сьогодні найбільш часто використовують віртуальні валюти для розробки та впровадження нових цифрових продуктів і сервісів, наприклад, у галузі блокчейн-технологій або цифрових платіжних систем. Отже, саме вони й стануть об'єктом нашого дослідження. Метою роботи є представити власний спосіб оцінювання фінансових ризиків та обґрунтувати його ефективність порівняно з уже сталими. При цьому запропонований підхід ураховує специфіку використання віртуальної валюти підприємствами. У результаті представлено кореляційно-регресійний аналіз впливу окремих факторів на рівень узагальнюючих індикаторів ретроспективного оцінювання ризику використання віртуальної валюти для обраних нами підприємств. Використовуючи дані, представлені в статті, менеджмент може прогнозувати зміну узагальнюючих індикаторів ретроспективного оцінювання ризику використання віртуальної валюти залежно від зміни відповідних показників-факторів.

Ключові слова: фінанси, фінансові ризики, валюта, віртуальна валюта, діяльність підприємств, управління, оцінювання ризику, віртуальні активи

JEL Класифікація: G32, G41, O32, L17