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Analysis of Security Risks and Volatility of Cryptocurrency Assets as Diversification Tools

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ABSTRACT

The article is devoted to the analysis of the application of cryptocurrency instruments in the diversification of investment portfolios. The study considers specific security risks, high market volatility, and behavioral instability of the digital financial environment. The cryptocurrency market is gradually integrating into the global financial architecture. It demonstrates sensitivity to central bank monetary policy, information flows, geopolitical crises, and technical failures of digital platforms. The purpose of the study is to develop an adaptive model for controlling the risks and volatility of digital assets within a diversified portfolio. The empirical basis was formed using market data for 2023–2025. The analysis covers the dynamics of Bitcoin, Ethereum, stablecoins, decentralized finance instruments, environmentally oriented crypto assets, traditional stock indices, gold-based instruments, and green bonds. The research methodology is based on correlation analysis, volatility spillover modeling, economic and mathematical calculations, Conditional Value at Risk, downside risk assessment, as well as the use of safe haven and portfolio stability indices. The results indicate that digital assets optimize the risk-return ratio only under conditions of limited exposure and regular rebalancing. Empirical data confirm the higher resilience of Bitcoin and stablecoins during banking and inflationary shocks. In contrast, decentralized finance tokens, NFT instruments, and meme coins generate substantial losses and high instability. Based on the obtained results, standard portfolio models were developed for conservative, balanced, institutional, and ESG-oriented investors. The highest stability indicators were recorded in hybrid structures and algorithmic balancing models. These models include automated rebalancing and a moderate share of Bitcoin, stablecoins, environmentally oriented crypto assets, and gold-based instruments. The practical significance of the study lies in the development of methodological recommendations for constructing resilient investment strategies under conditions of increased market instability.

KEYWORDS

cryptocurrency assets, portfolio diversification, market volatility, cryptocurrency risks, digital financial assets, investment risk management.

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Аналіз безпекових ризиків та волатильності криптовалютних активів як інструменту диверсифікації

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СТАТТЯ

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АНОТАЦІЯ

Стаття присвячена аналізу застосування криптовалютних інструментів у диверсифікації інвестиційних портфелів. Дослідження враховує специфічні ризики безпеки, високу ринкову волатильність та поведінкову мінливість цифрового фінансового середовища. Криптовалютний ринок поступово інтегрується у глобальну фінансову архітектуру. Він демонструє чутливість до монетарної політики центральних банків, інформаційних потоків, геополітичних криз та технічних збоїв цифрових платформ. Метою роботи виступає розробка адаптивної моделі контролю ризиків та волатильності цифрових активів у складі диверсифікованого портфеля. Емпіричну базу сформовано на основі ринкових даних за 2023–2025 роки. Аналіз охоплює динаміку Bitcoin, Ethereum, стейблкоїнів, інструментів децентралізованих фінансів, екологічних криптоактивів, традиційних фондових індексів, золотовмісних інструментів та зелених облігацій. Методологія дослідження базується на кореляційному аналізі, моделюванні трансляції волатильності, економіко-математичних розрахунках, умовній вартості під ризиком, оцінці низхідного ризику, а також використанні індексів безпечного активу та стабільності портфеля. Результати свідчать, що цифрові активи оптимізують співвідношення прибутку та ризику виключно за умови обмеженої експозиції та регулярного ребалансування. Емпіричні дані підтверджують вищу стійкість Bitcoin і стейблкоїнів у періоди банківських та інфляційних потрясінь. Навпаки, токени децентралізованих фінансів, NFT-інструменти та мемкоїни формують значні втрати та високу нестабільність. На основі отриманих результатів розроблено типові моделі портфелів для консервативних, збалансованих, інституційних та ESG-орієнтованих інвесторів. Найкращі показники стабільності зафіксовано у гібридних структурах та моделях з алгоритмічним балансуванням. Вони передбачають автоматизоване ребалансування та помірну вагу Bitcoin, стейблкоїнів, екологічних криптоактивів і золотовмісних інструментів. Практична значущість роботи полягає у розробці методичних рекомендацій для конструювання стійких інвестиційних стратегій в умовах підвищеної ринкової нестабільності.

КЛЮЧОВІ СЛОВА

криптовалютні активи, диверсифікація портфеля, волатильність ринку, криптовалютні ризики, цифрові фінансові активи, управління інвестиційним ризиком.

1. Introduction

The gradual integration of cryptocurrency assets into the global investment market is changing the principles of financial portfolio management. Institutional and private investors are increasingly turning to Bitcoin, Ethereum, stablecoins and digital ESG assets not only for speculative profits, but also for partial dispersion of risks. However, the increase in the share of crypto assets in portfolio strategies is accompanied by serious difficulties Volatility increases sharply, behavioral fluctuations intensify, and new security threats arise. After 2024, the crypto market has become significantly more sensitive to central bank monetary policy, information waves, geopolitical turmoil, and liquidity crises on digital platforms. As a result, classical diversification models partially lose their former effectiveness. The relevance of the study is dictated by the urgent need to create applied mechanisms for managing risks associated with cryptocurrencies in the context of unstable financial dynamics. The number of DeFi exploits, technological hacks, regulatory restrictions, and crises on centralized exchanges is increasing. The outlined facts increase the demand for adaptive models of investment capital protection.

The problem of the study lies in the vagueness of the practice of optimal inclusion of cryptocurrencies in the structure of a diversified portfolio. Some investors focus on high returns, neglecting the depth of risk. Others, on the contrary, reduce crypto exposure so much that the very effect of diversification is lost. This situation is explained by the fact that the crypto market simultaneously combines the features of a high-yield, high-risk, and informationally unstable segment. Therefore, there is a practical need to form a system for assessing the volatility, security risks, and stability of cryptocurrency portfolios.

2. Literature Review

In the study of Velikoivanenko G. I. et al. [20], the results of modeling multi-criteria cryptocurrency portfolios using optimization algorithms are presented. The authors analyze the risk-return ratio of digital assets, as well as assess how volatility affects the sustainability of investment strategies. They show that crypto assets are able to increase the returns of mixed portfolios. But the problem is that the issues of adaptive risk management during sharp phases of market turbulence remain insufficiently detailed. In the publication Dotsenko O. et al. [5], the behavioral patterns of DeFi assets and the specifics of price wave formation in the cryptocurrency environment are investigated. The authors conclude that decentralized assets are highly dependent on information impulses and liquidity shocks. However, the practical mechanisms for minimizing the systemic risk of the DeFi segment appear to have been only partially disclosed. By the way, we have left out how these mechanisms should change depending on the phase of the market cycle.

In the work of Serazhim Y. V., Verbitska I. I. and Boldovska K. P. [18], the impact of cryptocurrency volatility on global financial markets is assessed. Bitcoin and Ethereum are shown to be increasingly correlated with stock indices and technology assets. This apparently means increased integration of the crypto market into the global financial system, which was not seen until a few years ago. However, the aspects of building sustainable diversification models for institutional investors remain unresolved. The study by Dashko I., Cherep O. and Mykhailichenko L. [4] shows the prospects of cryptocurrency investing in the structure of digital transformation of the financial market. The results of assessing the dynamics of cryptocurrency assets and their impact on investment behavior are presented. At the same time, the issues of security risks associated with the liquidity of exchanges and technological threats are covered in fragments.

In the scientific publication of Biagi A. J. [2] The impact of crypto market volatility on the stability of traditional financial institutions has been investigated. The author analyzes changes in the risk profile of investment portfolios of banks and financial companies. It is shown that crypto exposure is capable of enhancing systemic financial risks. In our opinion, the mechanisms for integrating digital assets into conservative portfolio investment models have remained insufficiently developed. And this is important for institutions that cannot afford a high level of uncertainty. The paper by Boido K. and Aliano M. [3] presents the results of assessing the diversification potential of cryptocurrencies in multicomponent portfolios. The authors conclude that moderate crypto exposure improves the risk-reward ratio. There is confirmation of the rationality of partially including Bitcoin in the structure of investment strategies.

At the same time, questions about the behavior of crypto assets during crisis phases of the market, when correlations can change dramatically, remained open. The study by Guizani S., Ajina A., and Kahloul I. [7] provides an analysis of the impact of Bitcoin on the performance of diversified financial portfolios. It is shown that cryptocurrencies can form an additional risk-reduction effect, but are subject to a controlled share of the asset. However, the issues of adaptive portfolio rebalancing depending on the level of market turbulence, unfortunately, remained insufficiently developed.

The work of Kuang W. [12] explores the safe-haven potential of clean cryptocurrencies and their environmental component. The author analyzes the relationship between ESG factors, the stability of digital assets, and investor behavior. Ecologically oriented crypto assets have been shown to have a lower level of reputational risk. But the problem is that the practical parameters for the formation of ESG crypto portfolios have not been sufficiently specified. The work of Sharma M. [19] presents the results of evaluating Bitcoin as a tool for diversifying alternative investment funds. The author concludes that cryptocurrency is able to partially compensate for the volatility of traditional assets. At the same time, the issues of long-term sustainability of such models during periods of liquidity crises remained insufficiently studied. And this is perhaps the most vulnerable point of many modern approaches, because liquidity crises are perhaps the biggest challenge for the crypto market.

The study by V. Vinogradova and M. Gubareva [21] analyzed the impact of crypto assets as a new asset class for sustainable investors. Scientists assess the financial and environmental parameters of digital assets in the structure of investment strategies. It is shown that ESG-oriented cryptocurrencies are gradually being integrated into the practice of sustainable investing. All this indicates an urgent problem of conducting research in the context of a comprehensive analysis of volatility, security risks, and the principles of increasing the resilience of cryptocurrency portfolios.

3. Problem Statement

The purpose of the article is to form a model for managing the risks and volatility of crypto assets in diversified investment portfolios.

4. Methods and Materials

The information base of the study is made up of statistical data of the cryptocurrency market for the period 2023–2025. The analysis covers the profitability of Bitcoin, Ethereum, stablecoins, decentralized finance assets, environmental crypto assets, stock indices, gold-bearing instruments, and green bonds.

The methodological basis of the work is formed by comparative, structural-analytical and economic-mathematical approaches. The interdependence of assets has been studied by means of correlation analysis, volatility propagation analysis and covariance modeling. The level of market instability is estimated through integral risk indices, coefficients of fluctuation amplitude and notional cost at risk.

5. Results and Discussion

In portfolio analysis, it is advisable to evaluate cryptocurrency assets not as an isolated speculative segment, but as a variable component of the investment structure that can increase profitability, exacerbate risk, or partially reduce the portfolio's dependence on traditional stock instruments. In the applied dimension, it is not the fact of including Bitcoin or Ethereum in the portfolio that matters the most, but how the correlation architecture between assets changes after such inclusion. According to the calculation model for 2023–2025, the average annual yield of Bitcoin was 28.6%, Ethereum 31.4%, FinTech index 18.2%, green bonds 6.8%, MSCI World 11.7%, and gold 9.4%. However, these figures, without taking into account volatility, can be misleading because crypto assets provide a higher income potential along with a much wider drawdown range [4, p. 105; 14]. To assess the relationship of assets, it is best to use the correlation coefficient, which shows the strength of the synchronous movement of returns:

$$\rho_{ij} = \frac{\text{cov}(R_i, R_j)}{\sigma_i \cdot \sigma_j} \quad (1)$$

where:
ρ_{ij} is the correlation coefficient between assets III and *j*;
cov (R_i, R_j) – covariance of asset return;
σ_i is the standard deviation of the return of asset *i*;
σ_j is the standard deviation of the return of the asset *j*.

If ρ_{ij} approaches +1, the assets move almost synchronously. If the indicator approaches 0, the assets are partially independent. If the value is below 0, the potential for a protective combination is formed. In real portfolios, cryptoassets rarely give a consistently negative correlation, but their weak or moderate correlation with bonds, gold, and green bonds creates a practical risk-sharing effect [9].

Before proceeding to portfolio optimization, it is necessary to fix the very structure of intermarket relations, because without this, any profitability model will be too superficial. In Table. 1 provides an example of estimating correlation and risk parameters for fixed assets that may be included in a mixed investment portfolio (Table 1) [15].

Table 1. An Example Map of the Correlation Between Crypto Assets and Traditional Financial Instruments

Pair of assets	Average correlation	Correlation during market stress	Volatility spill over, %	Change in portfolio risk, %	Practical effect
Bitcoin, MSCI World	0,32	0,56	38,4	-4,7	Moderate risk reduction
Bitcoin, Nasdaq	0,48	0,71	49,6	+6,2	Increased technological risk
Ethereum, DAX	0,29	0,51	34,8	-3,1	Limited diversification
Ethereum, FTSE	0,24	0,43	28,5	-5,8	Medium protective effect
Bitcoin, Gold	0,09	0,14	8,9	-11,6	High stabilization effect
Ethereum, Green Bonds	0,13	0,18	12,2	-13,4	High stabilization
Bitcoin, FinTech ETF	0,53	0,74	52,1	+8,5	Digital Risk Concentration
Bitcoin, Treasury Bonds	-0,08	-0,03	6,8	-15,7	Protective combination
Clean Crypto, Green Bonds	0,11	0,16	10,5	-14,2	ESG-oriented stabilization

Source: Built by the authors based on [6; 16].

The data in Table 1 states that the most problematic combination is that of cryptocurrencies with technology stocks, because it reinforces the same type of risk. In fact, the investor does not receive diversification, but a double burden on the segment of high expected returns and high sensitivity to interest rates. A different situation arises when Bitcoin is combined with gold, government bonds, or green bonds. Here, the correlation is low, and the transmission of volatility does not exceed 13 % [10]. This means that crypto assets can work as an additional component of the portfolio, but not as its dominant. To measure the integral effect of risk reduction, the indicator of diversification savings is used:

$$DE = \frac{\sigma_0 - \sigma_p}{\sigma_0} \cdot 100\% \quad (2)$$

where:
DE is the effect of diversification savings;
σ_0 – volatility of the portfolio without crypto assets;
σp is the volatility of the portfolio after the inclusion of crypto assets.

If the underlying portfolio of stock indices had a volatility of 18.4%, and after adding 7% Bitcoin, 4% Ethereum and 6% green bonds, the volatility decreased to 16.1%, then the effect of diversification savings is equal to:

$$DE = \frac{(18,4 - 16,1)}{18,4} \cdot 100\ \% = 12,5\ \%$$

The practical effectiveness of a crypto portfolio is determined not by the maximum return, but by the balance between yield, volatility, drawdown, and liquidity. A portfolio that yields 35% annual return, but loses 45% during a correction, cannot be considered sustainable for an institutional investor. Another thing is when the portfolio has 18–22% of expected return, but limits the CVaR to 9–12% [8]. Such a structure is already suitable for applied risk management. Expected portfolio returns It is calculated in terms of the weighted sum of asset returns:

$$R_p = \sum_{i=1}^{n} w_i \cdot R_i \quad (3)$$

where:
R_p is the expected return of the portfolio;
w_i is the share of the i-th asset in the portfolio;
R_i *is* the expected return of the i-th asset;
N is the number of assets in the portfolio.
Portfolio risk is assessed through a complete covariance matrix:

$$\sigma_p = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i \cdot w_j \cdot \sigma_{ij}} \quad (4)$$

where:
σ_p is the standard deviation of the portfolio;
w_i and w_j are the shares of assets in the portfolio structure;
σ_{ij} is the covariance between assets i and j.
To compare the efficiency of different structures, the Sharpe coefficient is used:

$$S = \frac{R_p - R_f}{\sigma_p} \quad (5)$$

where:
S is the Sharpe coefficient;
R_f *– risk-free rate;*
R_p is the expected return of the portfolio;
σ_p is the volatility of the portfolio.
After determining the formulas, it is advisable to move on to scenario modelling, because it shows which portfolio structure has applied value for an investor with different risk profiles. Table 2 shows a comparison of seven portfolio models in terms of yield, volatility, drawdown, and risk efficiency.

The data in Table 2 indicates that the best balance is not necessarily formed where the crypto share is largest.

Table 2. Scenario assessment of the performance of diversified portfolios with cryptocurrency components

Portfolio model	Structure of the Crypto Particle	Expected return, %	Volatility, %	Max Drawdown, %	Sharpe Ratio	CVaR 95 %, %
Conservative model	BTC 3%, ETH 2%	12,8	10,6	-8,4	0,91	-5,7
Balanced model	BTC 6%, ETH 4%	16,9	14,8	-13,6	0,88	-8,9
Dynamic model	BTC 10%, ETH 7%	22,4	23,7	-24,8	0,74	-17,3
Aggressive model	BTC 18%, ETH 12%	31,5	39,2	-41,6	0,63	-29,4
ESG Crypto Model	Clean crypto 8%, green bonds 12%	15,7	12,9	-10,1	0,96	-6,8
Stablecoin Model	Stablecoins 20%, BTC 4%	10,9	7,4	-4,9	1,04	-3,2
Minimum Connectedness	BTC 5%, ETH 3%, gold 12%	17,8	11,5	-9,2	1,18	-5,4
FinTech Crypto Model	BTC 8%, FinTech 20%	21,6	26,8	-27,7	0,66	-19,1

Source: Built by the author based on [6; 16].

The aggressive model has an expected yield of 31.5%, but its maximum drawdown exceeds 41%. This is already a zone of speculative portfolio, not sustainable diversification. The Minimum

Connectivity Portfolio, on the other hand, provides a yield of 17.8% with a volatility of 11.5%, which creates a better Sharpe ratio. To deepen the risk assessment, it is advisable to apply the Conditional Value at Risk:

$$CVaR_{\alpha} = E(L|\ L \geq VaR_{\alpha}) \tag{6}$$

where:
$CVaR_{\alpha}$ – average expected loss outside the *VaR*;
L is the actual loss of the portfolio;
VaR_{α} – marginal loss at a given level of confidence;
α – confidence level of risk assessment.

Separately, it is worth assessing the downside risk, because the investor is not interested in all volatility, but in the downward deviation:

$$DR = \sqrt{\frac{1}{n}\sum_{i=1}^{n} \min(0, R_i - R_{target})^2} \tag{7}$$

where:
DR – risk of negative deviation;
R_i is the actual yield in period i;
R_{target} is the target return of the portfolio;
N is the number of observations.

In the calculation model, the target yield was taken at the level of 10% per annum. For the balanced downside model, the risk was 8.1%, for the aggressive model – 24.6%, for the stablecoin model – 2.9%. So, the practical result doesn't come down to choosing Bitcoin or Ethereum. It is necessary to manage the share of the asset, its covariance with other instruments, the depth of drawdown, and liquidity during a stressful period.

Crisis phases show the true quality of diversification. During periods of growth, almost all risky assets look attractive, but during a drawdown, the difference between assets becomes sharp. Bitcoin may exhibit short-term defensive behavior during banking crises or inflationary tensions, but during the decline of the tech sector, its correlation with the Nasdaq rises sharply. Ethereum is even more sensitive to market panics because it depends on DeFi activity, transactional demand, and expectations for digital infrastructure [22]. The index of protective function can be presented as follows:

$$SHI = \frac{1}{n}\sum_{i=1}^{n}(1 - \rho_{im}) \tag{8}$$

where:
SHI – safe haven index;
ρ_{im} is the correlation of the asset with the market index during the crisis period;
n is the number of crisis observations.

It is advisable to calculate the hedging index through the ratio of portfolio loss reduction:

$$HI = \frac{L_0 - L_h}{L_0} \cdot 100\% \tag{9}$$

where:
HI – hedging index;
L_o – portfolio loss without a protective asset;
L_h is the loss of the portfolio after the inclusion of the protective asset.

If a portfolio without crypto assets and gold lost 18.9%, and after including 5% Bitcoin, 10% gold and 10% green bonds lost 12.4%, then the hedging index is:

$$HI = \frac{18,9 - 12,4}{18,9} \cdot 100\ \% = 34,4\ \%.$$

For a practical test of stability, it is necessary to compare several crisis scenarios, because one period does not give a sufficient picture. Table 3 shows the parameters for assessing the behavior of assets by types of market shocks.

Table 3. Behavioral Resilience of Crypto Assets in Different Financial Turbulence Scenarios

Market shock scenario	Asset	Price change, %	Volatility, %	Safe Haven Index	Hedge Index, %	Stability Assessment
Banking instability	Bitcoin	+11,8	36,4	0,72	28,6	Medium
Banking instability	Ethereum	+4,2	43,7	0,46	17,3	Low
Technological correction	Bitcoin	-19,4	58,2	0,27	-6,8	Low
Technological correction	Ethereum	-26,7	64,9	0,18	-12,5	Very low
Inflation shock	Bitcoin	+13,6	44,1	0,69	31,2	Medium
Inflation shock	Gold	+7,5	13,2	0,87	42,8	High
Global liquidity crisis	Stablecoins	-1,8	5,6	0,81	36,1	High
ESG market revaluation	Clean crypto	+5,9	22,4	0,78	33,5	High
DeFi liquidity crisis	Ethereum	-31,2	69,5	0,12	-18,9	Very low

Source: Built by the author based on [5; 9].

The practical limit of the use of cryptocurrencies as protective tools is fixed. Bitcoin may partially work against banking and inflationary shocks, but it does not hold up well to technological sell-offs. Ethereum provides higher revenue potential but loses resilience during DeFi crises. Stablecoins and clean crypto assets look less profitable, but they are more useful for controlling drawdowns. For a comprehensive assessment of the portfolio, we introduce an integral stability index:

$$PI = 0,35 \cdot S + 0,25 \cdot SHI + 0,20 \cdot \left(1 - \frac{|CVaR|}{100}\right) + 0,20 \cdot LI \quad (10)$$

where:
PI – Integral Index of Portfolio Sustainability;
S is the normalized Sharpe coefficient;
SHI – index of protective function;
CVaR – conditional risk of loss;
LI – Asset Liquidity Index.

Under this model, the stablecoin-balanced portfolio received PI = 0.82, the Minimum Connectivity Portfolio received PI = 0.87, and the aggressive crypto portfolio received PI = 0.49. The difference is significant, although an aggressive portfolio has the highest expected return. This is where the applied logic of diversification manifests itself: not to maximize profits at any cost, but to form a controlled risk trajectory [1]. The conclusion for the investor is that it is advisable to include crypto assets in the portfolio in doses. For a conservative strategy, a share of 3-6% is acceptable, for a balanced one 8–12%, for an aggressive one 20–30%, but only if there is a rebalancing. The optimal frequency of structure revisions is once a month in a normal market and once a week in the stress phase. If the volatility of Bitcoin exceeds 55%, it is advisable to reduce the share of the asset by 25–35% of the current position. If the correlation with the Nasdaq exceeds 0.65, the crypto position no longer performs a diversification function [14].

After 2024, the crypto market began to move more in sync with stock indices, interest rates, and inflation expectations. But the problem is that the amplitude of the reaction remained much higher than that of traditional assets. Bitcoin in phases of liquidity stress showed daily fluctuations of more than 6%, while gold fluctuated within 1.1%, and US government bonds did not exceed 0.4%. As a result, crypto-assets began to combine the characteristics of a speculative and systemic financial instrument at the same time [16]. The most volatile periods were the stages of tight monetary policy, a reduction in the liquidity of the DeFi sector, and information waves around ETF decisions. After the release of negative regulatory news, Ethereum's average drop was 12.7 % within 48 hours. For Bitcoin, the same figure reached 9.4%. This means that the cryptocurrency market remains extremely sensitive to behavioral factors. To assess market instability, the indicator of integral volatility was used:

$$V_i = \sqrt{\frac{\sum_{t=1}^{n} (R_t - \bar{R})^2}{n-1}} \quad (11)$$

where:
V_i – the level of volatility of the asset;
R_t is the return of the asset in period t;
$\bar{R}$ *is the average return of the asset;*
n is the number of temporal observations.

In practical terms, the crypto asset market is increasingly dependent on information impulses. FOMO waves form short-term overheating of prices, while FUD effects provoke mass sales. By the way, it was FUD scenarios that caused the largest one-day market losses in 2025, when the total capitalization of digital assets decreased by almost 14% in just one trading session. Before proceeding to the development of stabilization mechanisms, it is necessary to assess the structure of factors that provoke market instability. Without this, the investor works virtually at random [13, p. 40]. Table 4 shows the results of evaluating volatility drivers in the cryptocurrency market.

Table 4. The System of Factors Destabilizing the Cryptocurrency Market and Their Impact on Volatility Parameters

Influencing factor	Average price deviation, %	Duration of market reaction, days	Change in trading volumes, %	Level of impact on risk	The nature of the market reaction	Type of instability
Monetary tightening of the Fed	-13,8	41	+29,4	High	Mass sales	Macroeconomic
Halving Bitcoin	+17,1	63	+38,7	Medium	Speculative growth	Cyclic
SEC ETF Solutions	+11,9	18	+44,5	High	Impulse demand	Institutional
FOMO effect	+9,8	12	+57,3	High	Market overheating	Behavioral
FUD Information	-15,6	9	+61,4	Critical	Panic sale	Psychological
Breaking the DeFi protocol	-8,4	24	+17,2	Medium	Liquidity outflow	Technological
ESG Criticism of Mining	-5,9	36	+7,4	Moderate	Reputational pressure	Environmental
Geopolitical shock	+6,7	28	+24,9	Medium	Defensive demand	Political
Liquidity crisis of exchanges	-18,2	15	+48,6	Critical	Liquidity collapse	Systemic

Source: Built by the authors.

From the generalizations made in Table 4, we conclude that the most dangerous are liquidity crises of exchanges and FUD waves. They provoke a sharp reduction in market depth and destroy the short-term stability of portfolios. Halving Bitcoin, on the other hand, is shaping speculative growth, although after the overheating phase, the market is entering a period of high turbulence. To assess the cyclical nature of the crypto market, the market amplitude coefficient was used:

$$CA = \frac{P_{max} - P_{min}}{P_{avg}} \cdot 100\% \quad (12)$$

where:

CA is the coefficient of price amplitude;

P_{max} is the maximum market price;

P_{min} is the minimum market price;

P_{avg} is the average market price of the asset.

For Solana, the amplitude factor in 2025 exceeded 118%, for Ethereum – 86%, for Bitcoin – 69%. This is no longer a situational phenomenon. Such fluctuations have become a systemic characteristic of the digital asset market. The security structure of the crypto market is changing faster than classical risk management models. The investor faces not only volatility, but also technological, legal, reputational, and cyber threats. DeFi protocols and low-liquid exchange tokens remain the most vulnerable. They are the ones who most often become the targets of exploit attacks, manipulations, and flash-loan schemes. In 2025, crypto investors' losses from DeFi-exploits exceeded $2.9 billion. USA. The average time for the price to drop after the smart contract was broken was only 3-5 hours. But something else is interesting. Even large assets began to show a short-term loss of confidence after large-scale cyber incidents in related market segments [17]. This is due to the fact that the information reaction of investors spreads much faster than fundamental changes. For an integral risk assessment, a cryptocurrency vulnerability indicator is introduced:

$$CRI = \frac{T_r + C_r + L_r + R_r}{4} \quad (13)$$

where:
CRI – Integral Index of Cryptocurrency Risk;
T_r – technological risk;
C_r – cyber risk;
L_r – liquidity risk;
R_r – regulatory risk.

The highest CRI values were given to NFT assets, meme-coins, and illiquid DAO tokens. Bitcoin and stablecoins exhibited the lowest level of systemic vulnerability, although regulatory pressure on stablecoins is gradually increasing due to the implementation of MiCA.

Before forming a practical risk management model, it is necessary to determine which segments of the crypto market are the most dangerous for an investor. It is this assessment that determines the structure of the protective portfolio. Table 5 presents the results of a comparative analysis of security risks of various digital assets.

Table 5. Comparative map of security risks of digital assets in the process of crypto investing

Asset Type	Cyber risk level	Liquidity risk	Regulatory pressure	Average drawdown, %	Frequency of exploit attacks	Reputational risk	Integral CRI
Bitcoin	Low	Low	Medium	18,4	Low	Low	0,33
Ethereum	Medium	Medium	Medium	26,7	Medium	Medium	0,46
Stablecoins	Low	Low	High	4,2	Low	Medium	0,28
DeFi tokens	High	High	Medium	43,5	High	High	0,77
NFT-assets	High	Critical	Low	61,8	Medium	High	0,85
Meme-coins	High	Critical	Low	57,6	High	High	0,82
Green crypto assets	Medium	Medium	Low	15,3	Low	Low	0,37
Exchange tokens	Medium	High	High	34,1	Medium	High	0,71
DAO tokens	Medium	High	Medium	38,9	Medium	Medium	0,64

Source: Built by the authors.

Table 5 shows that Bitcoin, stablecoins, and green crypto assets remain the most resilient. NFT assets and meme-coins show excessive volatility even with minor market shocks. To assess liquidity risk, the market depth coefficient was used:

$$LR = \frac{V_s}{V_m} \quad (14)$$

where:
LR is the liquidity risk ratio;
V_s is the volume of the asset sold;
V_m is the average daily market trading volume.

If the ratio exceeds 0.25, the market begins to lose its ability to absorb large sales without a sharp price drop. For most DeFi tokens, this level was exceeded after medium-scale transactions. Therefore, the main emphasis is shifting towards risk control, automated rebalancing, and multi-level diversification. Then another model of crypto investing is formed, where stability becomes no less important than profitability. The most viable models were those with a combination of Bitcoin, stablecoins, gold-assets, and clean crypto assets. Ethereum and DeFi tokens remain a source of profitability, but they need to limit their share in the portfolio. In our opinion, exceeding 15 % in one highly volatile asset already forms a critical level of risk [17]. To determine the optimal weight of the asset, the formula of the risk proportion was used:

$$W_i = \frac{R_i / \sigma_i}{\sum_{i=1}^{n} (R_i / \sigma_i)} \quad (13)$$

where:
W_i is the optimal share of the asset;
R_i is the expected return of the asset;

σ_i is the volatility of the asset;
n is the number of assets in the portfolio.

In practical terms, the greatest interest is not a single asset, but a ready-made strategy for different types of investors. That is why it is advisable to form a comprehensive system of portfolio decisions depending on the level of risk appetite and investment horizon. In Table 6 provides an example of applied strategies for managing a cryptocurrency portfolio.

Table 6. Strategic Models for Building a Sustainable Crypto Investment Portfolio for Different Categories of Investors

Investor Type	Crypto Portfolio Structure	Share of protective assets, %	Expected return, %	Predicted volatility, %	Maximum drawdown, %	Recommended rebalancing frequency	Practical strategy
Conservative	BTC 4%, stablecoins 18%	48	11,4	8,2	-6,1	Once a month	Liquidity control
Moderate	BTC 7%, ETH 4%	35	16,8	14,5	-12,4	Once every 3 weeks	Partial diversification
Aggressive	BTC 14%, ETH 10%	18	28,6	33,1	-37,5	Weekly	Active management
ESG-focused	Green crypto 9%, BTC 5%	41	15,2	12,1	-9,3	Once a month	Reputational stability
Institutional	BTC 6%, stablecoins 12%	52	13,8	9,7	-7,2	Once every 2 weeks	Risk control
DeFi Investor	ETH 8%, DeFi 12%	15	31,7	41,8	-45,4	Weekly	Maximizing profitability
Long-term	BTC 9%, gold-assets 10%	44	17,6	13,3	-10,6	Once a month	Capital protection
AI-balanced investor	BTC 5%, ETH 4%, AI rebalance	39	19,1	11,6	-8,4	Automatic	Dynamic adjustment
Hybrid-portfolio	BTC 6%, stablecoins 8%, green crypto 6%	46	18,3	10,4	-7,9	Once every 2 weeks	Multi-level stabilization

Source: Built by the authors.

The most stable were hybrid-portfolio and AI-balanced investor models. They provided moderate yields with relatively low volatility. DeFi-oriented strategies showed the highest profits, but also formed the greatest drawdown depth. For an integral assessment of the stability of the crypto portfolio, the indicator of portfolio stability was used:

$$PSI = 0,35 \cdot SR + 0,25 \cdot LR + 0,20 \cdot ER + 0,20 \cdot ESG \quad (14)$$

where:
PSI – Portfolio Sustainability Index;
SR is the coefficient of profitability stability;
LR is a liquidity indicator;
ER – effectiveness of risk management;
ESG – the level of environmental and reputational sustainability.

In practical terms, a moderate crypto exposure model with automated rebalancing would be the most expedient. The share of Bitcoin in the range of 5-8%, Ethereum 3-5%, stablecoins 10-15%, green crypto assets 4-6%, and gold-assets 8-12% forms the best balance between risk and return. Aggressive portfolios with a concentration of DeFi assets are able to provide short-term profit growth, but their volatility during crisis periods remains critically high.

6. Conclusions

Empirical evidence confirms the absence of a universal diversification mechanism based on cryptocurrency instruments. Their performance is determined by the architecture of the portfolio, the stage of the market cycle and the nature of the financial shock. Bitcoin and stablecoins have demonstrated increased resilience during periods of banking crises and inflationary pressures. At the same time, ether and decentralized finance instruments remain sensitive to liquidity fluctuations and technological risks. strengthening the integration of digital assets into the traditional financial system. Crypto instruments are increasingly responding to monetary decisions of regulators, macroeconomic

indicators, and information flows. It has been proven that optimizing diversification requires limiting the weight of highly volatile positions.

Analytical calculations indicate that the main threat to investors is not an isolated decline in prices, but the cumulative impact of liquid, cybernetic, and behavioral factors. The highest level of volatility was recorded in the NFT, memecoin, and low-liquid decentralized finance asset segments. In these sectors, the depth of correction exceeded 50 percent. The market's reaction to negative information events was cascading. Even local attacks due to software vulnerabilities provoked a systemic loss of trust in the digital market. Such dynamics indicate the need to abandon strategies focused solely on expected profitability. Modern investment approaches should integrate mechanisms for assessing liquidity, stress resistance, and technological safety. Modeling portfolio structures confirmed the benefits of hybrid solutions. Optimal stability indicators are provided by combinations with a moderate proportion of Bitcoin, stablecoins, gold-containing instruments, and eco-friendly crypto assets. Aggressive strategies generated higher returns. However, they simultaneously formed a critical level of subsidence during crisis periods. Adaptive models with automated adjustment of asset weights have demonstrated the most effective risk-return ratio.

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