
Can Bitcoin Replace Gold in an Investment Portfolio in the Polish Capital Market?

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Abstract:

Purpose: The aim of the article is to conduct an empirical assessment of whether Bitcoin can serve as a substitute for gold as a safe-haven asset and as a risk-diversification instrument in an investment portfolio on the Polish capital market. The analysis focuses on comparing the properties of both assets under conditions of heightened macroeconomic and geopolitical uncertainty, as well as their impact on the performance of portfolios based on the WIG20 index.

Design/Methodology/Approach: The study is based on weekly data for the period 2018–2025, covering phases of economic stability, the COVID-19 pandemic, the war in Ukraine, the conflict in the Gaza Strip, and the subsequent stabilization period. Rates of return, risk measures, and correlations of gold and Bitcoin with selected stock and commodity indices were compared. Diversification potential was evaluated using the classical Markowitz portfolio model, analyzing returns and risk of minimum-variance portfolios and examining portfolio efficiency via the Sharpe ratio.

Findings: The results indicate that Bitcoin generated higher returns than gold during periods of relative stability; however, during episodes of pronounced geopolitical turbulence it exhibited substantially higher volatility and deeper price declines. Consequently, it did not display the characteristics of a safe-haven asset. Gold, by contrast, showed low correlation with the equity market and demonstrated the ability to mitigate losses under heightened risk aversion. In portfolios based on the WIG20 index, the inclusion of gold consistently reduced total risk and frequently improved the risk–return profile. Bitcoin enhanced return potential only at the cost of significantly increased volatility, while its diversification function weakened or disappeared in periods of elevated geopolitical tension.

Practical Implications: For investors operating in the Polish capital market, gold remains an asset with confirmed safe-haven properties and an effective tool for reducing portfolio risk in times of economic and political turmoil. Bitcoin may be useful only for investors who accept high volatility and pursue return maximization; however, it does not constitute an adequate substitute for gold from the perspective of capital protection.

Originality/Value: The article provides added value by conducting a comparative analysis of gold and Bitcoin in the context of the Polish capital market, which differs from developed markets in terms of structure, liquidity and institutional maturity. Accounting for distinct phases of the geopolitical cycle enables a more precise assessment of the stability and

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protective properties of the analyzed assets under heightened uncertainty. The findings offer insights of significant relevance for investors and researchers examining the role of alternative assets in portfolios on emerging markets. This analysis expands the existing literature on alternative investment instruments and constitutes a meaningful contribution to the discussion on the role of gold and Bitcoin in modern investment strategies.

Keywords: Gold, Bitcoin, safe haven, alternative investments, profitability, portfolio diversification, Polish capital market.

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1. Introduction

In recent years, the global economic and financial system has experienced significant and dynamic changes, marked by elevated volatility and growing uncertainty driven by geopolitical, macroeconomic, and technological factors. The effects of the COVID-19 pandemic, the disruption of the international order following Russian aggression against Ukraine, and subsequent tensions in the Middle East have led to disturbances in global supply chains, rising inflation, and increased risk aversion among market participants. As a consequence, investors have been forced to reassess the notion of a “safe haven,” traditionally associated with gold.

The academic literature shows a growing interest in the concept of safe-haven assets, with particular attention given to the role of precious metals and cryptocurrencies (Syuhada, Suprijanto, and Hakim, 2022; Belanes *et al.*, 2024; Attarzadeh, Isayev, and Irani, 2024). Gold has historically served as the primary safe asset (Baur and Dermott, 2016; Wen, Tong, and Ren, 2022).

From an investor’s perspective, it plays a unique role in the global financial system: it offers protection against inflation, currency depreciation, and geopolitical risk, and it forms a core component of many investment portfolios due to its relatively low correlation with stock and bond markets (Morales and Andreosso-O’Callaghan,

2011; Rehman and Wu, 2025). Increasing demand from central banks and individual investors further confirms gold's continued importance within the international financial system.

At the same time, the market for digital assets has expanded rapidly. Rising financial awareness has made investors more open to new investment instruments and technological solutions. Bitcoin, initially viewed mainly as a technological experiment, gradually gained recognition as a speculative digital asset and later as an alternative store of value.

The principles of operation of Bitcoin are presented in Nakamoto's article (2008) and Dwyer's work (2015). Due to its limited supply and independence from traditional financial institutions, it has increasingly been described as "digital gold" or "gold 2.0," suggesting that it may serve as an alternative to traditional protective assets (Baur and Hoang, 2021).

Against the backdrop of such rapidly changing economic conditions, the question arises whether Bitcoin can, over the long term, fulfil a role similar to that of gold – or even replace it. Despite the growing number of studies on Bitcoin and gold, there is still a lack of research that directly compares the behaviour of both assets during periods of geopolitical and macroeconomic uncertainty, particularly in the context of the Polish market.

The aim of this article is to assess whether Bitcoin may serve as an alternative to gold, both as a safe-haven asset and as a tool for portfolio risk diversification. The results show that during periods of severe economic turmoil, Bitcoin records sharp price declines and increased risk, suggesting that it does not maintain its value in times of uncertainty.

Additionally, in the case of the Polish capital market, the analysis demonstrates that despite its low correlation with gold, Bitcoin does not contribute to reducing portfolio risk, in contrast to gold.

The rest of the paper is structured as follows: Section 2 reviews the empirical literature, Section 3 discusses the data and methods, Section 4 presents the main empirical results, and, finally, Section 5 concludes the study.

2. Literature Review

The literature on the subject is dominated by three main research streams. The first one deals with the role of gold as a safe haven and diversifier of an investment portfolio, the second refers to the analogous role of Bitcoin, while the third presents a comparative analysis of these two assets. Therefore, this review examines these three basic research streams.

2.1 The Role of Gold as a Safe Haven and an Effective Diversifier

Over the years, gold has gained a special place in culture and the economy, because it combines both material and symbolic qualities. Gold serves as a bridge between ancient and modern financial systems, and its future role – particularly in the context of digitalisation, global economic change, and rising geopolitical tensions – remains significant (Apanovych *et al.*, 2023; Baur and Smales, 2020). Investors typically turn to gold en masse when confidence in financial systems declines. In such situations, gold becomes a means of preserving value rather than generating profit (Hood and Malik, 2013; Lucey and Li, 2015; Ryan, Corbet, and Oxley, 2024).

Baur and Lucey (2010) examined whether gold serves as a safe asset on financial markets. They concluded that gold functions as a safe investment during crises. Meanwhile, Lucey and Li (2017) studied the role of precious metals as safe havens under varying temporal conditions and found that the strength of gold as a safe haven changes over time.

The rise in gold prices during financial crises has prompted many researchers to test its effectiveness as a safe haven against losses in other financial markets. A study of the gold market based on annual data from 1258–2018 confirmed that in the face of global crises, gold provides effective protection (Boubaker *et al.*, 2020). In turn, Beckmann, Berger, and Czudaj (2018) suggest that gold was able to protect investors only during the 2008 financial crisis.

A substantial body of academic work has also examined the impact of the COVID-19 pandemic on financial markets, particularly whether gold served as a hedge during this challenging period. The study by Akhtaruzzaman *et al.* (2021) provides an analysis of the role of gold as a safe asset at various stages of the COVID-19 crisis, corresponding to the introduction of fiscal and monetary stimulus aimed at supporting weakened economies.

Meanwhile, Cheema, Faff, and Szulczyk (2020) argue that gold lost its safe-haven status during the COVID-19 pandemic. Investors may have lost confidence in gold as a stable asset and a risk-hedging tool after it significantly declined in value between 2011 and 2015.

Gold is considered an effective diversifier of an investment portfolio due to its low or negative correlation with other asset classes, especially stocks and bonds, which allows for reducing overall portfolio risk. Incorporating gold into a portfolio—particularly during periods of heightened market volatility—reduces its risk while often increasing the rate of return (Conover *et al.*, 2007; Alqaralleh and Canepa, 2022; Vãn and Bào, 2022).

The literature also provides recommendations regarding the optimal share of gold in an investment portfolio, with suggested proportions ranging from 5% to 10% (Bruno

and Chincarini, 2010). Ngo, Nguyen, and Hoang (2024) found that the value of gold increases during crises and is not correlated with other assets, meaning it can serve as an “insurance policy” against economic and political turmoil.

However, the relationship between gold and other assets may vary depending on the type of crisis. In many cases, studies have shown that gold’s diversification potential is noticeable only in the short term (Bredin, Conlon, and Poti, 2015; Naeem *et al.*, 2022).

2.2 The Role of Bitcoin as a Safe Haven and Hedging Instrument

Cryptocurrencies have generated controversy since the very beginning. Since their emergence following the global financial crisis in 2008, an increasing number of market participants – especially younger and more technologically oriented individuals – have begun to recognize their potential as a means of payment, an alternative form of capital allocation, and a tool for capital protection.

Investors pay particular attention to the wide variety of cryptocurrencies, their accessibility, decentralization, anonymity combined with transparency, as well as the possibility of risk diversification through participation in innovative projects (Dumitrescu, 2017; Rusli and Zolkipli, 2021). At the same time, they point to price instability and high risk, the lack of uniform legal regulations, numerous frauds and financial manipulations, exposure to cyberattacks, and the fact that this technology consumes enormous amounts of energy, which has a significant impact on the natural environment.

To date, hundreds of cryptocurrencies have been created, but none have achieved as spectacular a success as Bitcoin. In economic and financial literature, there is growing interest in Bitcoin as a digital asset, yet clear empirical evidence of its safe-haven properties, hedging capabilities, and diversification potential is still lacking. Conlon and McGee (2020) demonstrated that Bitcoin may serve as a safe haven due to its independence from monetary policy and traditional financial systems, as well as its limited correlation with traditional assets.

The accelerated digitalization of finance further facilitates access to the cryptocurrency market for traditional investors, as well as new generations of investors (late millennials, Generation Z), for whom Bitcoin has become a modern store of value and is therefore often referred to as “digital gold” (Conlon, Corbet, and McGee, 2020) or “new gold” (Klein, Thu, and Walther, 2018). Baur, Hong, and Lee (2018), as well as Baur, Dimpfl, and Kuck (2018), found that Bitcoin is not correlated with traditional asset classes such as stocks or bonds.

Thus, despite its high volatility, including it in a diversified portfolio is highly profitable (Eisl, Gasser, and Weinmayer, 2015) and significantly improves portfolio performance thanks to substantially higher risk-adjusted returns (Platanakis and

Urquhart, 2019); however, it cannot provide risk hedging (Disli *et al.*, 2021). Rashid, Bakry, and Al-Mohamad (2023) indicate that Bitcoin is positively correlated with equity markets, which may limit its potential as a hedging instrument or safe haven for U.S. equity markets.

They showed that Bitcoin's properties may oscillate between diversification and hedging, however, this potential should be viewed with caution owing to the high volatility exhibited by Bitcoin. In unstable times, Bitcoin moves in line with other risky assets and does not serve as a safe haven, particularly as the world is slowly moving away from the dollar standard and returning to the gold standard.

2.3 Bitcoin and Gold

Bitcoin and gold share many common features: a limited supply and costly extraction process (Dyhrberg, 2016), a global character and freedom from government control (Baur, Dimpfl, and Kuck, 2018; Bouri *et al.*, 2020), the fact that neither instrument generates cash flows (Shahzad *et al.*, 2019), and, above all, their use as hedges against inflation and market risk, as well as their ability to provide diversification benefits.

The key differences, however, include their physical versus digital form, their history, their level of acceptance and social recognition (Shahzad *et al.*, 2020), and their intrinsic value. Moreover, Bitcoin faces two risks that gold does not – technical risk (related to computing power) and systemic risk (stemming from exposure to cyberattacks) (Harvey, 2025).

Understanding the extent to which gold and Bitcoin can serve as safe-haven assets during periods of increasing uncertainty is crucial for investors seeking not only to enhance returns but also to minimize risk. During the COVID-19 pandemic and the Russia-Ukraine conflict, gold maintained its status as a safe haven, while Bitcoin's performance proved inconsistent and often limited to specific markets or short-term horizons (Ji *et al.*, 2020; Aryan, Soleimani, and Shojaee, 2025).

Selmi *et al.* (2018) emphasize that Bitcoin and gold exhibit similar behavior during periods of economic uncertainty but differ during stable times, suggesting that the performance of these assets is closely tied to market conditions and investor perceptions of risk and safety. Conlon and McGee (2020) likewise found that Bitcoin does not function as a safe haven, as its price declines in tandem with the S&P 500 during periods of crisis. Their results cast doubt on Bitcoin's ability to provide protection against turbulence in traditional financial markets.

Bouri *et al.* (2017) and Guesmi *et al.* (2019) found that Bitcoin is an effective diversifying asset. Pho *et al.* (2021) conclude that gold serves as a more effective portfolio diversifier than Bitcoin, with gold-diversified portfolios outperforming those incorporating Bitcoin. Their findings further indicate that Bitcoin is better

suited to investors willing to take on higher risk, whereas gold remains the preferred asset for risk-averse investors.

Blau, Griffith, and Whitby (2021) found Bitcoin to be highly anti-inflationary, a conclusion supported by its close relationship with gold. Some studies also indicate that holding both gold and Bitcoin simultaneously in a portfolio may improve diversification, as these assets display safe-haven properties under different market conditions, particularly during wars and economic crises (Rehman and Vo, 2020; Oosterlinck, Reynolds, and Szafarz, 2023).

Despite their differences, both assets offer diversification potential and act as stores of value; however, gold – thanks to its long-standing tradition and well-established regulatory framework – provides investors with more consistent protection. Overall, available research suggests that Bitcoin may serve as a portfolio diversifier, but it should not be regarded as a substitute for gold.

3. Research Methodology

The study examines gold and Bitcoin. The analysis was conducted using data for the period January 2018 – October 2025 (prices in USD; the empirical data come from publicly available websites, including www.stooq.com; lbma.org.uk). Figure 1 presents a graphical representation of gold prices and Bitcoin.

Figure 1. Price developments of gold (right axis) and Bitcoin in the years 2018-2025.



Source: Author's calculations.

In order to capture variation in the behaviour of gold and Bitcoin across different phases of the business cycle, as well as during periods of geopolitical tension and economic crisis, five characteristic sub-periods were distinguished within the overall

research horizon:

- 01.01.2016 – 12.01.2020 – period of relative economic stabilization (Stabilization),
- 13.01.2020 – 23.02.2022 – period of the pandemic caused by the SARS-CoV-2 coronavirus (COVID-19),
- 24.02.2022 – 06.10.2023 – period from the moment of the Russian attack on independent Ukraine (Ukraine War),
- 7.10.2023 – 19.01.2025 – period since the Hamas attack on Israel (Gaza War),
- 20.01.2025 – 31.10.2025 – period of gradual economic stabilization amid ongoing geopolitical tensions (Stabilization_2).

The analysis was based on empirical data including weekly returns on gold and Bitcoin. To examine their potential as a safe-haven asset against the stock market, the Pearson linear correlation coefficient between the returns of these assets was calculated.

The results were compared with stock market indices: MSCI World, S&P500, and WIG 20, as well as commodity market indices: BCOM (Bloomberg Commodity Indices), and CRB Index.

In turn, the assessment of diversification potential was carried out for the Polish market in the period 2019-2025. The benchmark was a portfolio built on the basis of companies that are part of the WIG 20. It is based on the value of portfolio with shares in 20 major and most liquid companies in the WSE main list.

In the case of gold and Bitcoin, their prices were converted into the national currency at the average exchange rate of the US dollar (according to NBP data), while data on the share prices of individual companies were taken from the stooq.pl website.

The problem of determining optimal portfolio weights was solved using the decision-making model developed H. Markowitz (1952). Portfolios were constructed in accordance with the Markowitz framework, assuming minimization of risk. The following objective function was applied:

$$S_p^2 = X^T \cdot D \cdot X \rightarrow \min, \quad (1)$$

where:

X – vector of portfolio weights,

X^T – transposed vector of X,

D – variance-covariance matrix of rates of return.

With conditions:

$$X_i \geq 0 \text{ for } i = 1, 2, \dots, n, \quad (2)$$

$$\sum_{i=1}^n X_i = 1 \quad (3)$$

where: n – number of securities in the portfolio..

The rate of return on the portfolio (R_p) was determined by the formula:

$$R_p = \sum_{i=1}^n X_i \cdot R_i \quad (4)$$

where: R_i – the rate of return of the i -th security in the portfolio.

In addition to minimal risk portfolios, the parameters of portfolios with a given level of share of alternative instruments have also been determined. To assess the effectiveness of the investment portfolios, Sharpe Ratio (SR) was used (Sharpe, 1966):

$$SR = \frac{R_p - R_f}{S_p} \quad (5)$$

where: R_f – Risk-free return.

This ratio measures the excess return over the risk-free rate per unit of total risk, measured by standard deviation, and can be used to compare the performance of different investment portfolios. A higher Sharpe Ratio indicates a more favorable profit-to-risk relationship. Under Polish conditions, the risk-free rate was represented by the reference rate published by the NBP, converted to a weekly average.

4. Research Results and Discussion

4.1 Return and Risk of Gold and Bitcoin in Comparison with Selected Stock Market Indices

Table 1 shows the average rate of return and risk (based on standard deviation) of gold and Bitcoin over study periods.

During the COVID-19 pandemic and the conflict in the Gaza Strip, as well as throughout the entire analysed period, Bitcoin's returns were higher than those of gold. In these periods, an inflow of speculative capital was observed, which contributed to an increase in cryptocurrency valuations. Additionally, in 2024 global

markets anticipated the launch of the first Bitcoin ETFs in the United States; therefore, the geopolitical shock coincided with a fundamental growth stimulus for cryptocurrencies.

Table 1. Return and risk of gold and Bitcoin against selected stock indices in 2018-2025.

	Gold	Bitcoin	BCOM	CRB	MSCI	S&P500	WIG 20
Average weekly rate of return [%]							
Entire period	0.3027	0.9243	0.0747	0.1440	0.2127	0.2649	0.1013
Stabilization	0.1990	-0.0344	-0.0580	-0.0178	0.1297	0.2038	-0.1002
COVID-19	0.2034	2.0014	0.3263	0.3794	0.2494	0.3047	0.0518
Ukraine War	-0.0312	-0.0836	-0.0729	0.0994	-	0.0216	-0.0789
Gaza War	0.6211	2.2323	0.0247	0.1805	0.4380	0.5135	0.3283
Stabilization 2	1.0203	0.4545	0.1147	-0.0427	0.4570	0.4151	0.7724
Risk [%]							
Entire period	2.0304	9.1962	2.1969	2.4989	2.3874	2.4905	3.1573
Stabilization	1.4571	10.4972	1.4374	1.6445	1.8135	2.0241	2.3194
COVID-19	2.3573	10.5192	2.3422	3.2011	3.0072	3.0588	3.6871
Ukraine War	1.8865	8.0039	2.8252	2.8910	2.6050	2.6846	3.5919
Gaza War	1.9369	7.3209	1.6745	1.8103	1.6943	1.7732	2.7178
Stabilization 2	2.4978	5.1181	2.6127	2.1834	2.2159	2.3853	3.0905

Source: Authors' calculations.

Bitcoin, however, performed significantly worse during the war in Ukraine, when it recorded larger declines than gold. The war in Ukraine was not perceived by investors as a threat to the global financial system, but rather as an armed conflict of limited geographical scope.

As a result, following a short-term and sharp increase in gold prices in the first weeks after the outbreak of the war, a downward trend emerged. This was also reinforced by the policies of the Federal Reserve and the European Central Bank, which, in response to rising inflation, raised interest rates, thereby reducing the investment attractiveness of gold. In contrast, in 2025 gold proved more attractive than Bitcoin, which resulted from the actions of central banks and geopolitical factors.

Bitcoin is known for its high volatility, which may discourage investors seeking security for their assets. Both risk measured by standard deviation and by the coefficient of variation is higher for cryptocurrencies (with the exception of the COVID-19 pandemic period). Cryptocurrencies lack stabilising mechanisms and are more strongly linked to sentiment in the equity market than gold. This confirms that Bitcoin, under conditions of destabilisation and global risk, does not fulfil the function of a safe haven, but behaves as a high-risk asset. In the context of global tensions, inflation, and concerns about the US dollar, investors return to gold as a more stable asset.

It should also be noted that in most cases both gold and Bitcoin achieved better performance than the analysed stock market indices and commodity indices. Gold gains in times of crisis and uncertainty, attracts capital during periods of panic in capital markets, and benefits from accommodative monetary policy. To a large extent, the risk associated with gold is also lower than that of most indices.

Table 2 shows the correlation between gold and Bitcoin and the correlation with selected stock indices.

Table 2. *Correlation between selected stock indices and cryptocurrencies and precious metals in years 2018-2025.*

	Entire period	Stabilization	COVID-19	Ukraine War	Gaza War	Stabilization_2
Gold vs. Bitcoin	0.13647*	0.15040*	0.17925*	0.15625**	0.04732	0.03257
Gold vs. Index						
BCOM	0.37392*	0.20968*	0.34458*	0.40494*	0.54996*	0.46085*
CRB	0.21376*	0.11689**	0.17787*	0.32903*	0.33283*	0.18804**
MSCI	0.21741*	0.03674	0.30495*	0.30302*	0.11977***	0.04384
S&P500	0.16147*	0.00571	0.26030*	0.25334*	0.04841	-0.05037
WIG 20	0.17181*	0.03506	0.16334*	0.23230*	0.25257*	0.08274
Bitcoin vs. Index						
BCOM	0.20059*	0.13254**	0.35861*	0.19150*	-0.02642	0.11395
CRB	0.21839*	0.12677**	0.34435*	0.16752*	0.00521	0.29798*
MSCI	0.31231*	0.06937	0.39353*	0.47880*	0.18600*	0.51763*
S&P500	0.28957*	0.04563	0.35831*	0.49088*	0.17366**	0.48689*
WIG 20	0.23978*	0.06952	0.38898*	0.21306*	0.14673**	0.37177*

Note: Severity level – * $p < 0.001$, ** $p < 0.01$, *** $p < 0.05$.

Source: Authors' calculations.

There exists a weak or very weak positive correlation between gold and Bitcoin. Baur and Hoang (2021) argue that the low correlation between these two asset classes may stem from the substitution effect (investors sell gold and buy Bitcoin) or the catching up effect (investors buy Bitcoin to catch up with the market weight of gold).

The correlation between the returns of gold, Bitcoin and major stock market indices is, however, time-varying and dependent on the nature of the crisis. Gold is most strongly correlated with commodity indices, which is primarily a result of its weighting within these indices. The Bloomberg Commodity Index includes 24 commodity components, with precious metals accounting for over 20%, whereas the CRB Index contains approximately 7% precious metals.

As a commodity with a dual nature – investment and industrial – gold responds to similar factors as other commodities, which способствует convergence in their price

behaviour. By contrast, the correlation of gold with stock market indices, particularly the S&P 500, is significantly weaker, confirming its distinct role in investment portfolios. The correlation of Bitcoin with selected indices is higher compared to gold. This is particularly evident after Russia's invasion of Ukraine, which allows the conclusion that Bitcoin did not fulfil the role of digital gold.

The obtained results confirm that gold maintains a relatively low degree of interdependence with equity markets, which supports its role as an asset less sensitive to changes in the business cycle and more resilient to market and geopolitical shocks. Bitcoin, on the other hand, is strongly dependent on liquidity conditions and investor sentiment, and therefore behaves as a high-risk instrument, reacting to global turbulence in a manner similar to equity markets.

4.2 Gold and Bitcoin as Instruments for Investment Risk Diversification

The second stage of the study aimed to determine whether gold and Bitcoin serve as instruments that enable portfolio risk diversification. The analysis was conducted for the Polish market for the years 2019-2025. Majewska and Gierałtowska (2019) showed that, in the case of the Polish capital market, including gold in equity portfolios significantly improves their performance.

However, there is evidence that also Bitcoin may replace gold as a potential diversifier (Henriques and Sadorsky, 2018), despite drawbacks such as high volatility (Jeribi, Fakhfekh, and Jarbou, 2021).

Table 3 presents the minimum-risk portfolios constructed for individual annual periods. The portfolio return (RP) and risk (SP) were calculated, and for portfolios that include alternative instruments, the percentage share of each asset in the portfolio was determined. Additionally, the coefficient of variation (CV) and Sharpe Ratio (SR) were computed for the portfolios.

Table 3. Parameters of minimal risk portfolios for a portfolio containing listed companies from WIG 20 and alternative assets in years 2019-2025.

	Parametr	2019	2020	2021	2022	2023	2024	2025
WIG 20	Sp [%]	1.7517	3.8965	1.5205	2.8163	1.9050	1.9171	2.1262
	Rp [%]	0.2652	0.3444	0.5307	-0.1111	0.6658	-0.0467	0.8932
	SR	0.1348	0.0856	0.3444	-0.0760	0.2844	-0.0802	0.3712
	CV	6.605	11.314	2.865	—	2.861	—	2.380
WIG 20 + gold	Sp [%]	1.0254	2.3507	1.1678	1.4961	1.1700	1.2687	1.5738
	Rp [%]	0.2280	0.3536	0.3624	0.0472	0.2371	0.2820	1.0566
	Asset weight [%]	56.21	70.53	43.22	58.04	56.88	50.83	45.16
	SR	0.1941	0.1457	0.3043	-0.0373	0.0967	0.1379	0.6053
	CV	4.497	6.648	3.222	31.697	4.935	4.499	4.497

WIG 20 + Bitcoin	S _p [%]	1.6966	3.8921	X	2.8079	1.7575	1.8341	2.0327
	R _p [%]	0.3560	0.4225		-0.1536	0.7176	0.0607	0.8868
	Asset weight [%]	4.45	2.76		3.28	10.63	7.65	7.66
	SR	0.1927	0.1057		-0.0914	0.3378	-0.0252	0.3851
	CV	4.766	9.212		—	2.449	30.216	2.292

Note: X – The portfolio does not contain alternative assets.

Source: Authors' calculations.

The analysis of the results indicates that in all examined periods, adding gold and Bitcoin to the WIG20 portfolio reduced the level of risk compared to the baseline portfolio. This confirms the diversification function of these assets. During periods of heightened uncertainty (2020, 2022, 2024, and 2025), portfolios containing gold additionally generated higher returns than the benchmark.

In 2022, when geopolitical risk was at its highest, the risk of the portfolio including gold was almost half that of the equity-only portfolio. It can also be observed that adding gold to an equity portfolio improves the risk-return relationship (SR), meaning that investors may potentially offset part of the risk present in the stock market and thus better protect their portfolios.

A concerning finding, however, is that the Sharpe Ratios are generally low, which suggests that the Polish capital market is still in a maturing phase (with insufficient liquidity). Moreover, the Warsaw Stock Exchange is strongly influenced by macroeconomic factors on the one hand, and susceptible to capital outflows on the other, which further increases risk without a proportional rise in asset prices.

The share of gold in the portfolio varies across the years but typically exceeds 40%. This may be due to the highly correlated sector structure of the Polish WIG20 index, which is dominated by companies in the commodity-energy and banking sectors, whose performance is strongly tied to domestic economic conditions. As a result, a small exposure to gold is insufficient to meaningfully affect the overall portfolio risk. Only a larger allocation leads to a noticeable reduction in volatility.

In the case of Bitcoin, in all analyzed periods (except for 2021) we observe a reduction in risk compared to the benchmark portfolio, and in many instances there was also a simultaneous increase in returns (2019, 2020, 2023). An improvement in portfolio efficiency compared to the equity portfolio can also be noted; however, only in 2023 was the efficiency additionally higher than that of the portfolio containing gold. Similar results for diversified portfolios including cryptocurrencies were obtained by Ma *et al.* (2020).

Tables 4-5 show the parameters of the portfolios taking into account the different shares of gold and Bitcoin in the portfolios. Subjectively, values from 2% to 30% of

the share were assumed. The grey colour shows portfolios for which the risk was higher than the risk of the WIG 20 portfolio in a given year.

Table 4. Parameters of portfolios containing gold in years 2019-2025.

WIG 20 + gold	Portfolio Parametrs [%]	The weight of the alternative asset in the portfolio								
		2%	4%	6%	8%	10%	15%	20%	25%	30%
2019	SP	1.7120	1.6701	1.6294	1.5893	1.5500	1.4556	1.3674	1.2868	1.2138
	RP	0.2624	0.2645	0.2661	0.2678	0.2691	0.2722	0.2752	0.2793	0.2671
2020	SP	3.8605	3.7590	3.6910	3.6242	3.5583	3.3978	3.2440	3.0977	2.9603
	RP	0.3321	0.3469	0.3478	0.3484	0.3489	0.3499	0.3511	0.3522	0.3532
2021	SP	1.4919	1.4641	1.4372	1.4112	1.3863	1.3288	1.2789	1.2376	1.2043
	RP	0.5240	0.5162	0.5133	0.5090	0.5025	0.4863	0.4700	0.4548	0.4229
2022	SP	2.7464	2.6773	2.6092	2.5421	2.4757	2.3152	2.1631	2.0215	1.8924
	RP	-	-	-	-	-	-	-	-	-
2023	SP	1.8636	1.8229	1.7827	1.7433	1.7045	1.6111	1.5234	1.4424	1.3694
	RP	0.6509	0.6366	0.6217	0.6069	0.5919	0.5552	0.5170	0.4784	0.4398
2024	SP	1.8754	1.8304	1.7902	1.7510	1.7127	1.6216	1.5379	1.4629	1.3981
	RP	-	-	-	-	-	-	-	-	-
2025	SP	2.0268	1.9900	1.9544	1.9200	1.8868	1.8095	1.7415	1.6839	1.6376
	RP	0.9031	0.9109	0.9188	0.9266	0.9336	0.9535	0.9730	0.9927	1.0119

Source: Authors' calculations.

Table 5. Parameters of portfolios containing Bitcoin in years 2019-2025.

WIG 20 + Bitcoin	Portfolio Parametrs [%]	The weight of the alternative asset in the portfolio								
		2%	4%	6%	8%	10%	15%	20%	25%	30%
2019	SP	1.7134	1.6969	1.7032	1.7310	1.7793	1.9732	2.2485	2.5869	2.9738
	RP	0.3091	0.3407	0.3755	0.4002	0.4200	0.4643	0.5099	0.5570	0.6090
2020	SP	3.8916	3.8923	3.8980	3.9086	3.9242	3.9843	4.0735	4.1903	4.3340
	RP	0.4013	0.4573	0.5135	0.5683	0.6215	0.7591	0.8989	1.0355	1.1751
2021	SP	1.5676	1.6403	1.7365	1.8524	1.9848	2.3703	2.8079	3.2838	3.7842
	RP	0.5717	0.6133	0.6552	0.6965	0.7353	0.8039	0.8370	0.8618	0.8860
2022	SP	2.8078	2.8077	2.8161	2.8334	2.8593	2.9609	3.1103	3.3010	3.5268
	RP	-	-	-	-	-	-	-	-	-
2023	SP	1.8560	1.8162	1.7863	1.7668	1.7580	1.7834	1.8742	2.022	2.2145
	RP	0.6754	0.6857	0.6955	0.7052	0.7150	0.7395	0.7637	0.7984	0.8439
2024	SP	1.8777	1.8526	1.8379	1.8342	1.8413	1.9084	2.0442	2.2347	2.4685
	RP	-	-	-	-	-	-	-	-	-
2025	SP	2.0502	2.0400	2.0342	2.0328	2.0357	2.0619	2.1146	2.1935	2.2975
	RP	0.8931	0.8909	0.8886	0.8864	0.8842	0.8786	0.8731	0.8654	0.8564

Source: Authors' calculations.

The presented empirical results indicate that the structure of the investment portfolio plays a significant role in shaping the relationship between risk and rate of return. In the case of gold, all analyzed portfolio variants exhibited a lower level of risk

compared to the market portfolio; however, the impact on returns was diversified. Only in 2021 and 2023 was the rate of return of portfolios containing gold lower than that of the benchmark portfolio.

In contrast, in 2022 and 2025, and to a lesser extent in 2020 and 2024, even a small share of gold in the portfolio structure also improved its profitability. This may be attributed to increased demand for safe-haven assets during periods of economic uncertainty and heightened geopolitical tensions.

By contrast, portfolios including Bitcoin were characterized by significantly higher risk compared to the market portfolio. Although an increase in the cryptocurrency's share was accompanied by rising returns, Bitcoin's high volatility simultaneously led to a substantial increase in the overall risk of the portfolio.

The exceptions were 2022 and 2025, when for most portfolios including Bitcoin, returns were lower than those of the market portfolio while risk was considerably higher. This phenomenon was particularly evident in 2022, when portfolios with Bitcoin exhibited markedly higher volatility and recorded deeper losses than other portfolios, indicating their strong sensitivity to deteriorating market sentiment and their limited diversification function under crisis conditions. Table 6 presents the Sharpe ratios for the previously constructed portfolios.

Table 6. Sharpe Ratio (SR) for portfolios.

Year	SP for WIG 20	Portfolio WIG 20	The weight of the alternative asset in the portfolio								
			2%	4%	6%	8%	10%	15%	20%	25%	30%
2019	0.1348	+ gold	0.1363	0.1410	0.1455	0.1503	0.1549	0.1671	0.1800	0.1945	0.1962
		+ Bitcoin	0.1635	0.1837	0.2034	0.2144	0.2197	0.2206	0.2139	0.2041	0.1950
2020	0.0856	+ gold	0.0832	0.0894	0.0912	0.0931	0.0950	0.0997	0.1048	0.1101	0.1156
		+ Bitcoin	0.1003	0.1147	0.1289	0.1426	0.1556	0.1878	0.2180	0.2445	0.2686
2021	0.3444	+ gold	0.3465	0.3478	0.3523	0.3557	0.3574	0.3607	0.3620	0.3618	0.3453
		+ Bitcoin	0.3602	0.3696	0.3733	0.3722	0.3669	0.3362	0.2956	0.2603	0.2323
2022	-0.0760	+ gold	-0.0744	0.0738	-	0.0724	0.0696	0.0656	0.0607	0.0560	0.0489
		+ Bitcoin	-0.0867	0.0963	0.1065	0.1166	0.1261	0.1472	0.1643	0.1776	0.1882
2023	0.2844	+ gold	0.2827	0.2812	0.2792	0.2770	0.2745	0.2676	0.2580	0.2457	0.2306
		+ Bitcoin	0.2971	0.3093	0.3199	0.3290	0.3362	0.3451	0.3413	0.3335	0.3251
2024	-0.0802	+ gold	-0.0854	0.0766	0.0706	0.0642	0.0576	0.0397	0.0189	0.0038	0.0286
		+ Bitcoin	-0.0720	0.0561	0.0397	0.0221	0.0053	0.0378	0.0792	0.1150	0.1477
2025	0.3712	+ gold	0.3943	0.4055	0.4169	0.4284	0.4397	0.4695	0.4990	0.5278	0.5544
		+ Bitcoin	0.3849	0.3857	0.3857	0.3849	0.3833	0.3757	0.3637	0.3471	0.3275

Source: Author's calculations.

As noted earlier, the Sharpe ratio values remain relatively low, which may be a consequence of the immaturity of the Polish capital market as well as its lower liquidity and informational efficiency. Nevertheless, in most cases the inclusion of gold in the portfolio improved the risk–return relationship.

In the case of Bitcoin, this relationship proved to be considerably more diversified. There were periods in which the Sharpe ratio increased both relative to the market portfolio and to the portfolio containing gold (e.g. 2019, 2020, 2024).

These results are partially consistent with findings in the literature, which suggest that the inclusion of cryptocurrencies in an investment portfolio may improve the risk–return relationship; however, these benefits depend on the investor’s profile and investment horizon (Bhattacharjee, Mishra, and Kang, 2024; 2025). Most studies, however, focus on global markets (American and European), while research addressing local markets remains limited.

During the analyzed period, there were also years in which Bitcoin’s impact on portfolio efficiency was clearly negative (e.g. 2022 and 2025). This confirms earlier conclusions that unfavorable geopolitical conditions (the Russia–Ukraine war), monetary tightening, sharp declines in Bitcoin prices, and its positive correlation with the equity market led to an increase in the overall portfolio variance, even when the share of the cryptocurrency was relatively small.

The purpose of the study was to verify whether the relationships observed in global markets also occur in the Polish capital market, which remains a relatively young market undergoing intensive development. The results indicate that the inclusion of gold in a portfolio based on the WIG20 index led to a reduction in risk compared to the base portfolio, confirming the diversification function of this asset.

It can therefore be argued that gold continues to serve as a stabilizing component of the portfolio, enhancing its resilience to economic fluctuations and geopolitical events. Bitcoin, despite its dynamically growing market importance, still retains a highly speculative character, which limits its ability to serve as a substitute for gold as a safe haven.

In the Polish capital market, the inclusion of Bitcoin in an investment portfolio may contribute to higher returns; however, this is associated with a significantly higher level of risk. Consequently, this solution is primarily suitable for investors with a higher risk tolerance, whereas for highly risk-averse investors, gold remains a safe haven.

5. Conclusions, Proposals, Recommendations

In the face of financial market instability and declining trust in traditional forms of investing, such as stocks or bonds, a clear increase in interest in protective assets can be observed—those capable of serving as a hedge against inflation or sudden price declines. Globalization and the rapid technological development of financial markets have significantly expanded access to investment instruments, enabling individual investors to diversify their portfolios internationally and manage risk exposure more effectively.

Rising financial awareness among market participants has also contributed to greater openness toward innovative solutions and alternative asset classes. As a result, investing in alternative assets has become not only a way to enhance potential returns but also a strategy for risk management in a volatile and unpredictable economic environment.

Since the emergence of cryptocurrencies after the global financial crisis of 2008, interest in these assets has gradually increased, particularly regarding their potential to protect capital. Amid growing macroeconomic uncertainty, expansionary monetary policy, and declining trust in traditional financial institutions, some investors have begun to view cryptocurrencies—especially Bitcoin—as an alternative to conventional forms of wealth protection.

At the same time, the ongoing financialization of commodity markets has changed the role of traditional safe-haven assets. The growing share of derivatives, investment funds, and speculative capital has caused gold prices to react more strongly to financial factors rather than solely to fundamental supply-and-demand dynamics. Consequently, gold's ability to function as a protective and hedging asset has weakened during certain periods, encouraging investors to seek alternative forms of portfolio protection.

Although both assets share certain characteristics, such as limited supply, high acquisition costs, and being perceived as alternatives to fiat money, equating them is a significant oversimplification and is not fully justified by economic analysis. Their differences extend to their functions, risk profiles, and sources of value, meaning they play distinct roles in the financial system and cannot serve as substitutes within an investment portfolio.

Gold has real industrial and jewelry applications, as well as enduring scarcity due to limited natural resources. Bitcoin's value, on the other hand, relies entirely on market participants' trust, making it heavily dependent on investor sentiment and speculative dynamics.

The conducted research shows that Bitcoin, during stable periods, enables substantially higher returns than gold but performs poorly in extreme crisis situations (e.g., the outbreak of the war in Ukraine), experiencing much deeper declines in value. Gold is characterized by relatively stable price behavior, whereas Bitcoin displays extremely high volatility and susceptibility to sharp corrections, which limits its ability to act as a stabilizing element in a portfolio. Consequently, while gold typically reduces the overall risk of an investment portfolio, Bitcoin often leads to an increase in that risk.

Bitcoin currently does not meet the key criteria of a safe haven and cannot be regarded as a full substitute for gold in terms of portfolio stabilization and capital protection. In practical investing, it functions more as a high-risk asset that can

potentially enhance portfolio returns, but only at the cost of a marked increase in volatility.

It should also be emphasized that traditional cryptocurrencies (including Bitcoin) are increasingly viewed as an environmental threat due to exceptionally high electricity consumption and the resulting substantial carbon footprint. The mining process requires enormous computational power, which, in regions reliant on fossil fuels, leads to increased carbon emissions and heightened environmental pressure.

Consequently, ESG criteria are becoming more important in investment decisions, and environmentally conscious investors are increasingly abandoning high-emission cryptocurrencies in favor of so-called green cryptocurrencies that use more energy-efficient consensus mechanisms. The market is seeing a growing number of such initiatives, including Cardano, Tezos, and Nano, which prioritize energy efficiency and minimizing carbon footprint through innovative technologies and consensus mechanisms (Rehman and Wu, 2025).

The development and popularization of such solutions may in the future help reduce the negative environmental impact of the cryptocurrency market, support global sustainability goals, and potentially contribute to the transformation of the modern financial system.

A hybrid solution for investors may be gold-backed stablecoins (Wang, Ma, and Wu, 2020; Asadov, Yildirim, and Masih, 2023). The literature increasingly highlights their potential as substitutes for conventional cryptocurrencies, as the market for gold-backed cryptocurrencies has shown higher efficiency over longer investment horizons compared to the market for traditional cryptocurrencies.

However, it should be noted that existing analyses are still relatively limited, and the role of gold-backed stablecoins as effective diversification instruments across different phases of the market cycle and under geopolitical stress remains insufficiently explored.

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