

Analysis of the Relationship Between Bitcoin and Gold as Safe Haven Assets Against IHSG Movements in Indonesia: A DCC-GARCH

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Submitted: 12/05/2026; Revision Accepted: 22/09/2026; Published: 02/10/2026

How to cite this paper:

Analysis of the Relationship Between Bitcoin and Gold as Safe Haven Assets Against IHSG Movements in Indonesia: A DCC-GARCH Approach. (2026). *Proceedings of International Conference on Agro and Marine Industry*, 2(1). <https://journal.utu.ac.id/index.php/ICONAMI/article/view/340>

Abstract

This study examines the role of Bitcoin and gold as safe haven assets against movements in the Indonesia Composite Stock Price Index (IHSG). Using daily closing price data from Yahoo Finance and Investing.com over the period January 2018 to December 2025, this study employs the Dynamic Conditional Correlation–Generalized Autoregressive Conditional Heteroscedasticity (DCC-GARCH) model to estimate time-varying volatility and dynamic conditional correlations among the three asset return series. The 2018–2025 window covers four major shocks: the US–China trade war, the COVID-19 pandemic, the 2022 inflation surge, and the 2024 Bitcoin halving, including the US–China trade war (2018), the COVID-19 pandemic (2020), global inflationary pressures (2022), and the Bitcoin halving event (2024). Estimation results from 1,921 observations indicate that Bitcoin is not confirmed as a safe haven against the IHSG; rather, it functions as a diversifier with a weak positive average conditional correlation ($r = +0.0880$) and high volatility (standard deviation: 4.19%). Gold likewise does not fulfill the safe haven criteria against the IHSG, but exhibits stronger defensive characteristics with a lower average correlation ($r = +0.0491$) and considerably more stable volatility (standard deviation: 0.96). The DCC persistence parameter ($\alpha + \beta = 0.96$) shows that co-movement among asset pairs remains strong and stable throughout the 2018–2025 period. For Indonesian investors, gold offers more reliable protection in the long run, while Bitcoin may serve a diversification function for investors with higher risk tolerance.

Keywords: *Bitcoin; Gold; Safe Haven; IHSG; DCC-GARCH; Portfolio Diversification; Indonesian Capital Market.*

Introduction

In an increasingly integrated global financial system, economic uncertainty has risen significantly, posing major challenges for market participants. Events such as the 2008 global financial crisis, geopolitical tensions, and the COVID-19 pandemic have demonstrated that financial markets are highly sensitive to large-scale external shocks. Under such conditions, investors tend to reallocate portfolios toward assets capable of

preserving or increasing their value during periods of stress commonly referred to as safe haven assets [1] The existence of such assets is a critical component of portfolio risk management, particularly during periods of market instability. Markowitz [2] showed that combining assets with weak or negative correlations cuts overall portfolio risk a principle that directly motivates testing whether Bitcoin and gold can play this role relative to IHSG.

Historically, gold has been recognized as one of the most stable safe haven assets. Empirical studies show that gold tends to preserve its value during crisis periods, including the 1998 Asian monetary crisis, the 2008 global financial crisis, and the COVID-19 pandemic [1]. Gold is viewed not merely as a commodity but also as a monetary asset serving as a hedge against inflation, currency depreciation, and financial system instability. These characteristics are supported by its natural scarcity, physical durability, and long-established trust [3].

Bitcoin, introduced by Nakamoto [4] as a decentralized electronic payment system based on blockchain technology, has evolved beyond a payment instrument and is now positioned as an alternative investment asset. Bitcoin's algorithmically fixed supply ceiling of 21 million coins is frequently compared to gold's natural scarcity, prompting scholars to characterize it as "digital gold" [5]. The SEC's approval of spot Bitcoin ETFs in January 2024 marked a turning point: for the first time, retail and institutional investors could access Bitcoin through regulated channels, reigniting debate about its long-term role as a store of value.

Despite its growing recognition, Bitcoin's role as a safe haven has yielded mixed results empirically. Several studies have found that Bitcoin does not consistently exhibit a negative correlation with stock markets during crisis periods [6], [7]. Gold served as a safe haven while Bitcoin functioned only as a diversifier findings later corroborated for G7 markets by Shahzad et al. [7] and for Indonesian markets by Wijaya and Ulpah [8]. In the Indonesian context, Bappebti [9] data indicate that the number of crypto asset investors increased substantially, at certain points surpassing conventional capital market investors. Hidayat and Maisyarah [10] documented that Bitcoin exhibits price fluctuations far

exceeding those of major Indonesian stock indices over 2022–2024, underscoring the asymmetry in risk profiles between the two asset classes.

Despite this growing body of work, studies combining Bitcoin and gold within a DCC-GARCH framework specifically for the Indonesian market remain absent from the literature, particularly for the 2018–2025 period. The safe haven properties of both Bitcoin and gold against the IHSG using the DCC-GARCH framework over a data period spanning 2018–2025, encompassing multiple distinct crisis regimes. The present study aims to fill this gap, applying the framework of Baur and Lucey [1] to classify Bitcoin and gold as safe haven, hedge, or diversifier relative to IHSG.

LITERATURE REVIEW

Safe Haven Assets: Theoretical Framework

The conceptual foundation for classifying financial assets as safe havens originates from the seminal framework of Baur and Lucey [1], who defined three distinct categories: a safe haven is an asset uncorrelated or negatively correlated with the market during turmoil; a hedge is an asset uncorrelated or negatively correlated on average; and a diversifier is positively but not perfectly correlated on average. Most empirical safe haven studies since 2010 have adopted this three-way classification as their primary benchmark. Building on this, Baur and McDermott [3] extended the analysis to an international context, providing evidence that gold functions as a safe haven for major developed market equities, while its effectiveness in emerging markets is more limited and context-dependent an important consideration for Indonesia as a representative emerging market.

The theoretical case for portfolio diversification, which underpins safe haven analysis, was established by Markowitz [2], who demonstrated that combining assets with imperfect correlations reduces portfolio risk without proportionally reducing expected returns. This principle motivates the investigation of whether Bitcoin and gold assets structurally distinct from equities can reduce the variance of an IHSG-based portfolio, particularly during periods of market stress.

Gold as a Safe Haven Asset: Empirical Evidence

Gold has occupied a central position in the safe haven literature due to its long-standing role as a store of value, physical scarcity, and historical independence from monetary policy cycles. Baur and Lucey [1] provided foundational evidence that gold acts as a safe haven for stocks in the United States, United Kingdom, and Germany during periods of extreme negative market returns, though its safe haven status dissipates after approximately 15 trading days following a crisis shock. Later studies addressed this limitation by adopting time-varying models such as DCC-GARCH, which can track how correlations shift during and after a crisis.

The COVID-19 crash of March 2020 when IHSG fell over 30% in weeks offered a direct test of whether gold held its defensive value. Dutta et al. [11], using a DCC-GARCH approach, found that gold maintained its safe haven characteristics during the early phase of the pandemic. Ben Ameur et al. [12] confirmed that gold exhibits stronger safe haven characteristics than Bitcoin during geopolitical risk episodes, using GARCH combined with quantile regression across data spanning 2013–2021. Ustaoglu [13] further reinforced this finding during the Russia–Ukraine conflict, demonstrating that gold's defensive properties are more consistent than those of Bitcoin during war-induced market stress. In the Indonesian context, Robiyanto [14] confirmed that gold plays a defensive role in the Indonesian stock market, while Wijaya and Ulpah [15] found that gold can act as a hedge and safe haven during the COVID-19 pandemic in Indonesia, using quantile regression and simple linear regression on daily data before and during the pandemic.

Bitcoin as an Alternative Investment Asset

Bitcoin was introduced by Nakamoto [16] as a decentralized peer-to-peer electronic payment system operating without reliance on any central authority. Dyhrberg [5] was among the first to formally examine Bitcoin's hedging capabilities, finding that Bitcoin shares certain characteristics with both gold and the US dollar and proposing the concept of Bitcoin as "digital gold." The evidence on Bitcoin as a safe haven is far from settled. Shahzad et al. [7], using a quantile-based approach across G7 markets, found that Bitcoin qualifies as a weak safe haven only under specific extreme market conditions, while gold consistently demonstrates stronger safe haven characteristics. A subsequent study by the same authors

, employing an Economic Modelling framework, confirmed this asymmetry, classifying gold as a safe haven and Bitcoin primarily as a diversifier across different market regimes.

Shahzad et al. [7] found that Bitcoin's correlation with equity markets tends to increase during periods of financial stress precisely the opposite of safe haven behavior. Bhuiyan et al. [17], employing wavelet analysis combined with a multivariate DCC-GARCH approach across six stock market indices (three developed, three emerging), found that Bitcoin provides relatively better diversification opportunities than gold during times of crisis, though neither consistently qualifies as a safe haven across all markets. In the Southeast Asian context, Dung et al. [18] examined Bitcoin and gold as safe havens for Asian equity markets during financial distress using quantile regression, finding that gold demonstrates stronger safe haven properties than Bitcoin across the region, consistent with findings from the broader emerging markets literature.

Comparative Studies on Bitcoin and Gold Using DCC-GARCH

The DCC-GARCH model introduced by Engle [19] has become the dominant methodological tool in comparative safe haven research because it captures the time-varying nature of correlations between asset returns, which static models cannot accommodate. Engle [20] had earlier established the foundational ARCH framework, upon which GARCH and DCC-GARCH extensions were subsequently built. Unlike static correlation measures, DCC-GARCH tracks how asset co-movement shifts over time which matters because safe haven properties tend to emerge or disappear precisely during crisis episodes.

Several prominent studies have employed DCC-GARCH to directly compare the safe haven performance of Bitcoin and gold. Dutta et al. [11] found that gold functioned as a safe haven during the COVID-19 pandemic while Bitcoin behaved as a mere diversifier. Wijaya and Ulpah [15] reached comparable conclusions for the Indonesian market, finding that gold and Bitcoin exhibit time-varying defensive characteristics, though their study employed quantile regression rather than DCC-GARCH. Bhuiyan et al. [21] employed DCC-GARCH combined with wavelet coherence for both developed and emerging markets, finding that the hedging effectiveness of both assets is market-specific and time-varying.

Kumar et al.[22] advanced the methodology using rolling window DCC-GARCH across major international equity indices, demonstrating that safe haven properties of both assets are time-varying and crisis-dependent, with gold generally outperforming Bitcoin. Snene Manzli et al. [23] extended the analysis using DCC, ADCC, and GO-GARCH for BRICS-plus economies, confirming that during normal market periods both assets function primarily as diversifiers.

Safe Haven Research in the Indonesian and Emerging Market Context

Research on this topic in Indonesia is still limited. Most DCC-GARCH safe haven studies focus on US, European, or G7 markets. Robiyanto [14] conducted one of the earliest Indonesia-focused studies, confirming that gold plays a defensive role in the Indonesian market, though the study predates the major crypto asset expansion and does not include Bitcoin. Wijaya and Ulpah [15] addressed this gap by examining Bitcoin, Ethereum, and gold as hedge and safe haven assets on the Indonesian stock market before and during the COVID-19 pandemic, finding that all three assets can behave as hedging and safe haven instruments during the pandemic. However, their study used quantile regression rather than DCC-GARCH and did not cover the extended 2018–2025 period encompassing multiple crisis regimes.

Hidayat and Maisyarah [10] documented that cryptocurrency instruments in Indonesia particularly Bitcoin exhibit substantially higher volatility than conventional stock indices including IHSG over 2022–2024, thereby underscoring the risk asymmetry that investors must navigate. From a broader Southeast Asian perspective, Dung et al. [24] found that gold demonstrates stronger safe haven properties than Bitcoin across Asian equity markets during financial distress, consistent with patterns observed globally. What the literature has not yet addressed is a direct comparison of Bitcoin and gold against IHSG using DCC-GARCH across the full 2018–2025 period.

Research Methods

This study uses daily time series data and applies the DCC-GARCH model to analyze volatility and dynamic correlations among Bitcoin, gold, and IHSG. Secondary data consist of daily closing prices of Bitcoin and IHSG obtained from Yahoo Finance, and gold prices (XAU/USD) obtained from Investing.com. Analysis was conducted using Python, applying the DCC-GARCH model to estimate volatility and dynamic conditional correlations among the assets [19], consistent with Dutta et al. [11]. The daily data cover January 2018 to December 2025. This period was selected because it encompasses several episodes of global economic turbulence the US–China trade war (2018), the COVID-19 pandemic (2020), global inflationary pressures (2022), and the Bitcoin halving event (2024) thereby reflecting market dynamics across multiple regimes. Only dates when the IDX was open are included in the sample, yielding 1,921 matched observations across all three series. Specifically, because Bitcoin trades continuously (24/7) while IHSG operates only on Indonesian exchange business days, Bitcoin observations on IHSG non-trading days (weekends and public holidays) were excluded from the dataset. No interpolation was applied; only dates on which IHSG recorded a closing price were retained, yielding 1,921 matched observations for the three series.

Three variables are analyzed simultaneously: Bitcoin, gold (XAU/USD), and IHSG, all as daily closing price data. While IHSG serves as the reference market index for safe haven classification, all three series enter the DCC-GARCH system symmetrically. Each variable's price data is transformed into log returns using the formula

$$R_{_t} = \ln\left(\frac{P_{_t}}{P_{_t\{t-1\}}}\right) \times 100$$

The analytical procedure is as follows: (1) log return transformation; (2) stationarity testing using the Augmented Dickey-Fuller (ADF) test [25]; (3) ARCH-LM test to identify conditional heteroscedasticity; (4) DCC-GARCH estimation with model order selection based on the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) [19] the GARCH(1,1) specification was selected because it produced the lowest AIC/BIC values across all three return series and is well-established in the financial time series

literature as the most parsimonious and robust specification for daily asset return volatility, consistent with the approach of Dutta et al. [11]; (5) classification of each asset as safe haven, hedge, or diversifier based on the criteria of Baur and Lucey [1].

Results and Discussion

1.Descriptive Statistics of Daily Returns

Daily return data were computed using log returns over January 2, 2018 to December 24, 2025, yielding 1,921 observations (Table 1).

Table 1. Descriptive Statistics of Daily Returns (%)

Statistic	R_BTC (Bitcoin)	R_IHSG	R_XAU (Gold)
Obs. (N)	1,921	1,921	1,921
Mean (%)	0.0929	0.0155	0.0637
Median (%)	0.0851	0.0572	0.0672
Maximum (%)	21.0692	9.7042	7.9387
Minimum (%)	-42.5970	-8.7025	-5.8975
Std. Dev.	4.1921	1.0295	0.9598
25th Pct.	-1.6412	-0.4832	-0.4293
75th Pct.	1.9496	0.5623	0.5568

Source: Python Output, processed (2026)

Bitcoin records the highest standard deviation at 4.19%, substantially exceeding IHSG (1.03%) and gold (0.96%), confirming Bitcoin's markedly higher return volatility consistent with Hidayat and Maisyarah [10]. The extreme minimum return of -42.60% for Bitcoin, recorded during a period of acute crypto market stress, further illustrates the pronounced tail risk inherent to crypto asset exposure. By contrast, gold exhibits the most stable return distribution, with a minimum return of only -5.90%, consistent with its role as a defensive asset [1].

2. Stationarity Test Results (ADF Test)

All daily return series were tested for stationarity using the ADF test (Table 2).

Table 2. Stationarity Test Results (ADF Test)

Variable	t-Statistic	p-value	Lag	Result
R_BTC	-44.5037	< 0.0000	0	Stationary I(0)
R_IHSG	-10.8674	< 0.0000	14	Stationary I(0)
R_XAU	-43.9389	< 0.0000	0	Stationary I(0)

Source: Python Output, processed (2026)

All three return series yield ADF test statistics with p-values below 0.001, well below the conventional 5% significance threshold, confirming stationarity at level I(0). All three series are stationary at level I(0), confirming that GARCH estimation can proceed without risk of spurious results.

3. ARCH Effect Test Results (ARCH-LM Test)

The ARCH-LM test was conducted to identify conditional heteroscedasticity in the residuals of each variable with lag = 5 (Table 3).

Table 3. ARCH Effect Test Results (ARCH-LM Test, Lag = 5)

Variable	F-statistic	Prob. Chi-Sq(5)	Lag	Result
R_BTC	3.9449	0.0015	5	ARCH Effect Present
R_IHSG	94.4067	0.0000	5	ARCH Effect Present
R_XAU	20.6658	0.0000	5	ARCH Effect Present

Source: Python Output, processed (2026). Note: *** significant at $\alpha = 1\%$

The presence of significant ARCH effects across all three series confirms volatility clustering, thereby statistically justifying the application of the GARCH model for conditional variance estimation [20]. This finding aligns with the well-established stylized fact that high-frequency financial return series exhibit time-varying, clustered volatility.

4. GARCH(1,1) Estimation Results

GARCH(1,1) estimation was performed for each variable to obtain conditional variance estimates (Table 4).

Table 4. GARCH(1,1) Estimation Results by Variable

Variable	ω (omega)	α (ARCH)	β (GARCH)	$\alpha+\beta$	Status
R_BTC	0.6585	0.0534	0.9092	0.9626	Stationary
R_IHSG	0.0713	0.1521	0.7721	0.9242	Stationary
R_XAU	0.0459	0.0904	0.8605	0.9508	Stationary

Source: Python Output, processed (2026). Note: All coefficients significant at $\alpha = 1\%$

All coefficients are significant at the 1% level. The $\alpha+\beta$ values below 1 for all variables confirm stationarity of the conditional variance process. Bitcoin exhibits the highest volatility persistence (0.9626), followed by gold (0.9508) and IHSG (0.9242).

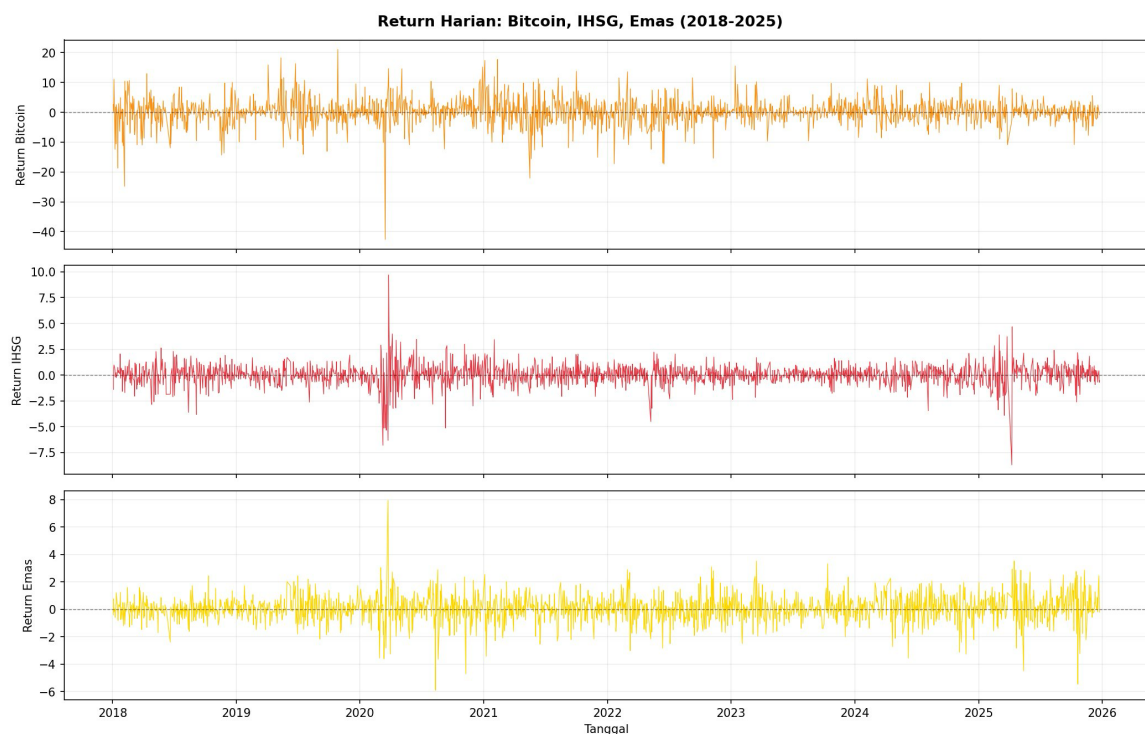


Figure. 1. Daily Returns of Bitcoin, IHSG, and Gold (2018–2025).

The figure illustrates the substantially higher return fluctuations of Bitcoin compared to IHSG and gold, with notable spikes during the COVID-19 crash (March 2020) and the crypto market stress episodes of 2018 and 2022. Source: Python Output, processed (2026).

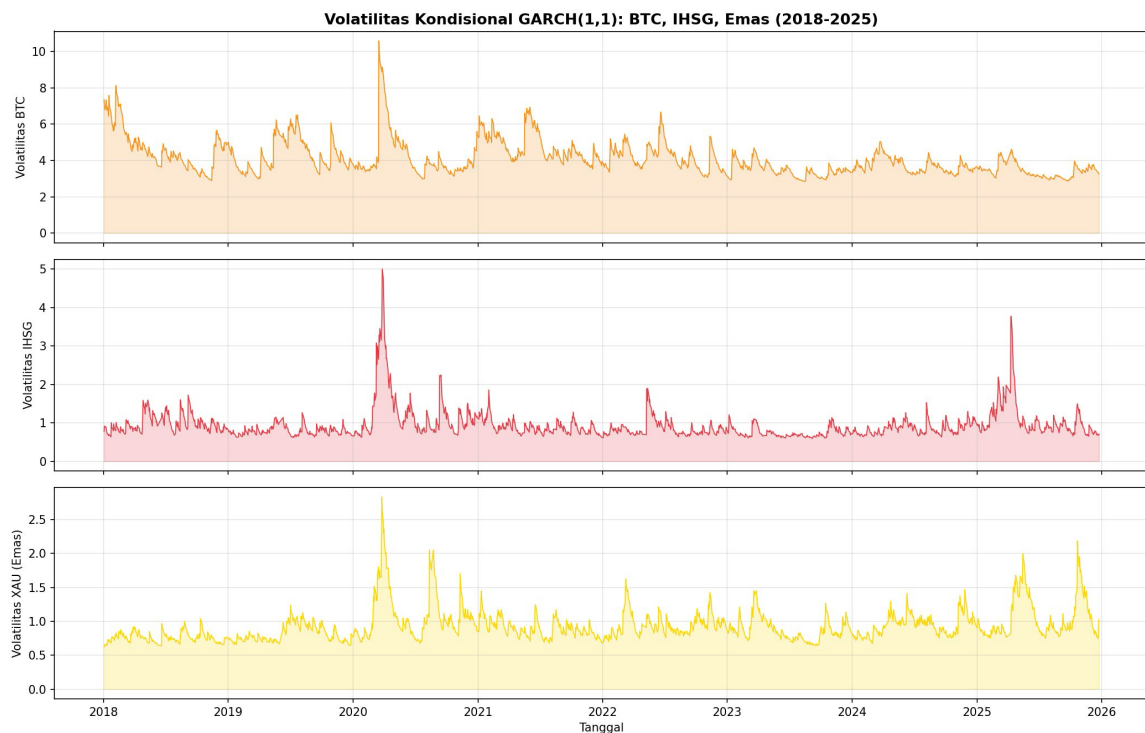


Figure. 2. Conditional Volatility GARCH(1,1): Bitcoin, IHSG, and Gold (2018–2025).

The figure presents estimated conditional volatility for each series, confirming Bitcoin's substantially higher and more persistent volatility relative to IHSG and gold across the full study period. Source: Python Output, processed (2026).

5. DCC-GARCH Estimation Results

5.1 DCC Parameter Estimates

Table 5. DCC-GARCH Parameters

Parameter	Value	Interpretation
α (ARCH DCC)	0.1900	Sensitivity to new shocks
β (GARCH DCC)	0.7700	Persistence of past correlations
$\alpha + \beta$	0.9600	Highly persistent correlation

Source: Python Output, processed (2026)

The $\alpha + \beta$ value of 0.9600 indicates highly persistent conditional correlations, consistent with Kumar et al. [22] and Snene Manzli et al. [23] who similarly documented high DCC persistence across global markets.

5.2 Dynamic Correlations and Safe Haven Classification

Table 6. DCC-GARCH Estimation Results and Safe Haven Classification

Asset Pair	Mean r	Min r	Max r	Classification
BTC – IHSG	+0.0880	- 0.7779	+0.7662	Diversifier
IHSG – XAU	+0.0491	- 0.7367	+0.8568	Diversifier
BTC – XAU	-0.0095	- 0.7893	+0.8988	Weak Negative Correlation

Source: Python Output, processed (2026).

Classification criteria [1]: Safe Haven = negative mean correlation with stock market during turmoil; Diversifier = weak positive correlation (0–0.3). Based on the criteria of Baur and Lucey [1]: (1) Bitcoin is classified as a diversifier against IHSG ($r = +0.0880$); (2) Gold is also classified as a diversifier against IHSG ($r = +0.0491$) It bears noting that safe haven classification, as operationalized by Baur and Lucey [1], requires assessing the correlation between an alternative asset and the equity market benchmark specifically. Accordingly, the BTC–XAU pairing ($\bar{r} = -0.0095$) while indicating a marginally negative average inter-asset correlation falls outside the scope of safe haven classification with respect to IHSG and is reported here for informational completeness only.



Figure 3. Dynamic Conditional Correlations DCC-GARCH (2018–2025).

The figure displays time-varying conditional correlations among Bitcoin–IHSG, Gold–IHSG, and Bitcoin–Gold pairs. Correlations exhibit significant fluctuations, particularly during the COVID-19 pandemic (2020) and global inflationary episode (2022). The BTC–IHSG correlation was predominantly negative in 2018–2019 before shifting toward positive territory. Source: Python Output, processed (2026) Figure 3 reveals that inter-asset correlations are dynamic and fluctuate throughout the study period. The BTC–IHSG correlation varies widely between -0.78 and $+0.77$, confirming that the relationship between assets is not static but contingent on prevailing market conditions, consistent with Dutta et al. [11]. These time-varying dynamics align with the broader evidence from Bhuiyan et al. [21] and Dung et al. [24] for emerging markets in Asia, where neither Bitcoin nor gold maintains consistent safe haven properties across all market regimes.

6. Summary of Findings and Implications

Table 7. Summary of DCC-GARCH Analysis Results

Asset	DCC Corr. vs IHSG	$\alpha+\beta$ GARCH	Classification	Investor Implication
Bitcoin (BTC)	+0.0880	0.9626	Diversifier	Suitable for diversification; not a crisis hedge
Gold (XAU)	+0.0491	0.9508	Diversifier	Low volatility; appropriate for defensive portfolios

Source: Python Output, processed (2026)

Overall, the results indicate that over 2018–2025, both Bitcoin and gold function as diversifiers rather than safe havens relative to IHSG. Gold exhibits more defensive characteristics with lower and more stable volatility than Bitcoin. For investors, gold is more appropriate as a long-term risk management instrument, while Bitcoin is better suited for diversification strategies among those with high risk tolerance findings that are consistent with the recommendations of Wijaya and Ulpah [15] for the Indonesian market and with the international evidence of Shahzad et al. [7] for G7 economies.

Conclusion

This study analyzed the role of Bitcoin and gold as safe haven assets against movements in the IHSG over January 2018 to December 2025 using the DCC-GARCH approach. Based on estimation results from 1,921 observations, three main conclusions are drawn. First, Bitcoin is not confirmed as a safe haven against IHSG. The DCC-GARCH estimation reveals an average conditional correlation of +0.0880, classifying Bitcoin as a diversifier under the criteria of Baur and Lucey [1]. Bitcoin's extremely high volatility (standard deviation: 4.19%) and volatility persistence of 0.9626 reinforce this finding. This is consistent with Dutta et al. [11], and Wijaya and Ulpah [15]. Second, gold is also not confirmed as a safe haven against IHSG over the full study period, functioning instead as a diversifier with an average conditional correlation of +0.0491. Nevertheless, gold exhibits

far more defensive characteristics, with lower volatility (standard deviation: 0.96%) and volatility persistence of 0.9508. These findings are consistent with Dutta et al. [11], who found that gold's safe haven role is conditional and regime-dependent.

Third, conditional correlations among all asset pairs are dynamic and time-varying, with the DCC persistence parameter ($\alpha + \beta = 0.96$) indicating highly persistent correlations that fluctuate across market regimes, particularly during the COVID-19 pandemic (2020) and global inflationary episode (2022). This confirms that the DCC-GARCH model effectively captures the changing relationships among assets in emerging markets such as Indonesia. For practitioners, these results suggest a simple rule: hold gold for downside protection, consider Bitcoin only if portfolio risk tolerance is high. Gold is more recommended as a defensive portfolio component, while Bitcoin may be considered for diversification purposes by investors with high risk tolerance. By extending the analysis to 2025 and applying DCC-GARCH to the Indonesian market specifically, this study fills a gap that existing studies — most of which end at 2022 or earlier — have left open. Three limitations should be noted.. First, the analysis covers the full sample period without regime-switching sub-period decomposition for instance, via Markov-switching DCC-GARCH which may obscure crisis-specific safe haven dynamics. Second, the asset universe is limited to three series; incorporating additional assets such as sovereign bonds or commodity indices would provide a broader comparative benchmark. Third, asymmetric volatility effects captured by GJR-GARCH or EGARCH specifications within the DCC framework were not explored, potentially understating the asymmetric response of correlations to negative market shocks. Future work could apply Markov-switching DCC-GARCH, include bonds and REITs, and test asymmetric models such as GJR-GARCH or EGARCH, as well as cross-country comparisons across ASEAN emerging markets.

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