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MORALITY BEFORE KNOWLEDGE

Geoeconomic risk and digital assets: Evaluating bitcoin's hedge role against Indonesia's stock market

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ABSTRACT

Background: This study assesses whether Bitcoin functions as a hedge and safe-haven against the Jakarta Composite Index/*Indeks Harga Saham Gabungan* (IHSG), particularly following the launch of the Spot Bitcoin ETF on January 10, 2024. Despite being widely portrayed as "digital gold," prior studies show mixed evidence on Bitcoin's protective role, especially in emerging markets. Given the relatively high volatility of the Indonesian stock market, evaluating Bitcoin's risk-mitigation potential becomes increasingly relevant. **Methods:** The analysis employs the Dynamic Conditional Correlation GARCH (DCC-GARCH) model to estimate time-varying correlations between Bitcoin and IHSG, alongside Ordinary Least Squares (OLS) and quantile regression to examine hedge and safe-haven behavior under normal and extreme market conditions. The study explicitly compares pre- and post-ETF periods to capture potential structural changes**. Findings:** results indicate that Bitcoin does not function as a hedge, reflected in its positive and volatile average correlation with IHSG. Quantile regression further shows that Bitcoin fails to provide protection at extreme IHSG quantiles, both before and after the ETF launch. DCC-GARCH estimates confirm that correlations are time-varying but remain predominantly positive, failing to meet safe-haven characteristics. Moreover, the Spot Bitcoin ETF launch did not significantly enhance Bitcoin's protective role, despite improving legitimacy and institutional participation. **Conclusion:** Overall, Bitcoin is better positioned as a diversifier with unstable correlation patterns rather than as a hedge or safe-haven for the Indonesian stock market, with important implications for investors, portfolio managers, and regulators. **Novelty/Originality of this article:** This study provides early emerging-market evidence on Bitcoin's hedge and safe-haven properties using a combined DCC-GARCH, OLS, and quantile regression framework while explicitly comparing pre- and post-Spot Bitcoin ETF periods.

KEYWORDS: bitcoin; emerging market risk; geoeconomic analysis; hedge; safe-haven.

1. Introduction

The COVID-19 pandemic represented one of the most severe systemic shocks to global financial markets in modern history (WHO, 2020). Since early 2020, disruptions in labor markets, global supply chains, and consumption patterns triggered sharp contractions in economic activity and unprecedented volatility across equity markets worldwide (Baker et al., 2020). Major stock indices experienced rapid and deep drawdowns within a short period, reflecting heightened uncertainty and panic-driven selling behavior. Compared with previous infectious disease outbreaks, including the 1918 influenza pandemic, COVID-19 generated substantially stronger stock market reactions, with extreme price movements largely driven by pandemic-related developments and government policy responses.

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Emerging markets were particularly affected during the early phase of the crisis, exhibiting stronger negative stock return responses than developed economies (Topcu & Gulal, 2020). Indonesia was no exception; the Jakarta Composite Index (IHSG) suffered a steep drawdown accompanied by elevated volatility, highlighting the vulnerability of emerging equity markets to global shocks and reinforcing the importance of identifying assets capable of mitigating portfolio risk under stressed conditions.

Beyond pandemic-specific effects, emerging equity markets are structurally more exposed to external shocks due to lower market depth, higher participation of retail investors, and greater sensitivity to global capital flows. Prior studies show that liquidity constraints and foreign equity trading can significantly amplify volatility in emerging markets, including Indonesia (Bekaert et al., 2007; Wang, 2007). During periods of global uncertainty, capital reallocation toward safer jurisdictions often intensifies return co-movements across risky assets, weakening domestic diversification benefits. These characteristics imply that conventional portfolio strategies developed in advanced economies may not translate effectively to emerging market contexts, underscoring the need for localized empirical assessment of hedge and safe-haven instruments.

Within the framework of Modern Portfolio Theory, portfolio risk is determined not only by individual asset volatility but also by the covariance and correlation structure among assets (Markowitz, 1952). Diversification therefore plays a central role in reducing overall portfolio risk, especially when combining assets with low or negative correlations. In this context, the concepts of hedge and safe-haven have become central in financial economics. A hedge is defined as an asset that is uncorrelated or negatively correlated with the market on average, thereby providing risk reduction under normal conditions, whereas a safe-haven refers to an asset that exhibits zero or negative correlation specifically during periods of market stress or extreme downturns (Baur & Lucey, 2010). This distinction emphasizes that safe-haven properties are inherently regime-dependent and cannot be inferred solely from average correlations. Baur & McDermott (2010) further demonstrate that even traditional defensive assets such as gold display heterogeneous hedge and safe-haven behavior across countries and time periods, highlighting the importance of market-specific evaluation.

Subsequent studies extend this framework by incorporating a broader set of assets and econometric approaches. Ciner et al. (2013) show that the hedge and safe-haven roles of gold, oil, bonds, and exchange rates vary substantially across crisis episodes, while Capie et al. (2005) and Beckmann & Czudaj (2016) document that gold's inflation-hedging capacity is time-varying and sensitive to macroeconomic regimes. These findings reinforce the view that protective asset characteristics are neither universal nor permanent. In emerging markets, where liquidity constraints, capital flow reversals, and retail investor dominance are more pronounced, safe-haven performance tends to be weaker and less stable (Bekaert et al., 2007; Wang, 2007). As a result, the applicability of hedge and safe-haven conclusions derived from developed markets remains limited for economies such as Indonesia.

Against this theoretical background, Bitcoin has increasingly been examined as a potential alternative hedge or safe-haven. Introduced as a decentralized peer-to-peer electronic payment system with a predetermined supply path, Bitcoin exhibits attributes such as scarcity, decentralization, and continuous global tradability (Nakamoto, 2008). These features have motivated comparisons with gold and fostered the narrative of Bitcoin as "digital gold." However, unlike traditional financial assets, Bitcoin generates no intrinsic cash flows, and its valuation is largely driven by investor expectations and speculative demand, contributing to extreme price volatility (Cheah & Fry, 2015). Behavioral evidence further suggests that most cryptocurrency participants are motivated by investment and trading considerations rather than transactional usage, implying that Bitcoin's price dynamics are closely tied to risk sentiment and momentum trading (Glaser et al., 2014).

Empirical studies on Bitcoin's hedge and safe-haven properties yield mixed and often contradictory results. Dyhrberg (2016) reports limited short-term hedging capabilities of Bitcoin against certain currencies and commodities, while Bouri et al. (2017) find that Bitcoin primarily functions as a diversifier with dynamic correlations rather than as a

consistent hedge. Using wavelet decomposition, Bouri et al. (2020) demonstrate that Bitcoin's relationship with equities depends on investment horizons and market regimes, with hedging benefits appearing only intermittently. Shahzad et al. (2019) compare Bitcoin with gold and commodities and conclude that Bitcoin exhibits weaker safe-haven characteristics, particularly during severe market downturns. Smales (2019) further argues that Bitcoin's high volatility and immature market structure undermine its defensive potential, rendering it unsuitable as a reliable refuge asset.

Evidence from crisis periods strengthens this skepticism. During the COVID-19 market collapse, Conlon & McGee (2020) show that Bitcoin moved in tandem with equity markets, thereby exacerbating portfolio losses rather than mitigating them. Mariana et al. (2021), employing DCC-GARCH and regression-based methods, identify only short-lived and fragile safe-haven behavior for Bitcoin and Ethereum during the pandemic, emphasizing the instability of crypto–equity linkages. Similar findings are reported in emerging market contexts. Wijaya & Ulpah (2022) document that Bitcoin fails to consistently act as a hedge or safe-haven for the Indonesian stock market, both before and during COVID-19. Collectively, these studies suggest that Bitcoin's protective role is highly conditional, episodic, and sensitive to market structure, casting doubt on its suitability as a defensive asset in volatile emerging economies.

A major structural shift in the cryptocurrency ecosystem occurred with the approval of Spot Bitcoin Exchange-Traded Funds (ETFs) by the U.S. Securities and Exchange Commission in January 2024. This development marked deeper integration between crypto assets and traditional financial markets by providing regulated access for institutional investors. Prior ETF literature suggests that exchange-traded products can alter asset price dynamics by affecting liquidity, volatility, and cross-market correlations (Ben-David et al., 2018; Da & Shive, 2016). In the cryptocurrency context, Liu & Yang (2024) show that Spot Bitcoin ETFs improved liquidity, legitimacy, and price discovery, while Babalos et al. (2025) document significant effects on returns and reduced volatility for several major cryptocurrencies following ETF approval. Although institutionalization may enhance market efficiency, it may also increase Bitcoin's integration with broader financial systems, potentially weakening any safe-haven properties. Existing empirical evidence remains largely concentrated on developed markets or pre-ETF periods, leaving limited understanding of how these structural changes influence Bitcoin's protective role in emerging markets, where equity volatility and sensitivity to global capital flows are substantially higher.

Motivated by these gaps, this study investigates whether Bitcoin functions as a hedge or safe-haven for the Indonesian stock market and whether the launch of the Spot Bitcoin ETF has materially altered this relationship. Using daily data from 2023 to 2025, the analysis combines Dynamic Conditional Correlation GARCH (DCC-GARCH) to capture time-varying correlations between Bitcoin and the Jakarta Composite Index (IHSG) with Ordinary Least Squares and quantile regression to examine hedge behavior under normal conditions and safe-haven properties during extreme market states, following the empirical framework of Mariana et al. (2021). By explicitly comparing pre- and post-ETF periods, this research provides early emerging-market evidence on the implications of Bitcoin's institutionalization for portfolio risk management. The contribution of this study lies in integrating dynamic correlation modeling with distribution-sensitive regression techniques in the Indonesian context, thereby extending the literature beyond developed markets and pre-ETF settings and offering practical insights for investors, portfolio managers, and regulators assessing Bitcoin's role within risk mitigation strategies.

2. Methods

This study employs a quantitative time-series approach to examine the hedge and safe-haven properties of Bitcoin against the Jakarta Composite Index (IHSG). Daily closing price data for Bitcoin and IHSG covering the period from January 2023 to December 2025 are utilized, capturing both pre- and post-Spot Bitcoin ETF market conditions. Bitcoin prices are

obtained from cryptocurrency market data providers, while IHSG data are sourced from the Indonesia Stock Exchange. Returns are calculated as logarithmic differences of consecutive daily prices to ensure stationarity and comparability across assets with different price levels (Dickey & Fuller, 1979). The selected sample period reflects the most recent phase of cryptocurrency market development and explicitly incorporates the structural change introduced by ETF approval. To evaluate the impact of the Spot Bitcoin ETF, the sample is divided into pre-ETF and post-ETF sub-periods using January 10, 2024 as the structural breakpoint.

The empirical analysis begins with descriptive statistics to characterize the distributional properties of both return series. Stationarity is assessed using the Augmented Dickey–Fuller test (Dickey & Fuller, 1979), while normality is examined through the Jarque–Bera test (Jarque & Bera, 1980). The presence of conditional heteroskedasticity is evaluated using the ARCH-LM test to justify volatility modeling (Engle, 1982). Prior to estimation, missing observations are removed and trading-day mismatches between Bitcoin and IHSG are aligned to ensure synchronized return series. Given the existence of volatility clustering in both Bitcoin and IHSG returns, univariate GARCH(1,1) models are first estimated for each series to capture time-varying conditional variances (Bollerslev, 1986) and to provide standardized residuals for subsequent multivariate analysis.

To analyze the dynamic relationship between Bitcoin and IHSG, the Dynamic Conditional Correlation GARCH (DCC-GARCH) framework is employed. This model allows conditional correlations to evolve over time, providing insight into changing dependence structures across market regimes (Engle, 2002). The DCC specification is particularly suitable in this context as it accommodates time-varying co-movement while maintaining parsimonious parameterization. The estimated dynamic correlations are used to assess whether Bitcoin exhibits hedge characteristics, defined as a non-positive average correlation with IHSG (Baur & Lucey, 2010). Furthermore, correlations during periods of extreme IHSG returns are examined to evaluate potential safe-haven behavior following the conceptual framework proposed by Baur & McDermott (2010).

In addition to DCC-GARCH, Ordinary Least Squares (OLS) regression is applied to test Bitcoin's hedge properties under normal market conditions. The IHSG return is specified as the dependent variable, with Bitcoin return as the main explanatory variable. A dummy variable representing the post-ETF period and its interaction with Bitcoin returns are included to capture potential structural changes following ETF approval, consistent with empirical approaches in cryptocurrency–equity market studies (Mariana et al., 2021). Robust standard errors are employed to account for potential heteroskedasticity. A statistically insignificant or negative Bitcoin coefficient is interpreted as evidence of hedging capability, consistent with prior hedge definitions (Baur & Lucey, 2010).

Safe-haven behavior is further investigated using quantile regression at lower quantiles (τ=0.05 and τ=0.10), representing extreme and moderately adverse equity market conditions. These quantiles correspond to the lower tail of the IHSG return distribution and capture periods of heightened market stress. This approach allows the relationship between Bitcoin and IHSG to be examined specifically during downturns, where safe-haven properties are theoretically expected to emerge (Koenker & Bassett, 1978). Similar to the OLS specification, ETF dummy interactions are incorporated to test whether Bitcoin's response to extreme equity movements changes after ETF introduction. Collectively, the DCC-GARCH, OLS, and quantile regression frameworks provide complementary perspectives on Bitcoin's role as a diversifier, hedge, or safe-haven across normal and extreme market states.

3. Results and Discussion

3.1 Descriptive statistics and preliminary analysis

Table 1 reports descriptive statistics for daily returns of Bitcoin and the Jakarta Composite Index (IHSG) over the sample period from 2023 to 2025. The results reveal

substantial differences in distributional characteristics between the two assets. Bitcoin exhibits considerably higher volatility than IHSG, as reflected in its standard deviation of 0.0319 compared to 0.0100 for IHSG, confirming Bitcoin's classification as a high-risk asset. This volatility gap indicates that Bitcoin experiences price fluctuations more than three times larger than those observed in the Indonesian equity market. Moreover, Bitcoin displays wider return extremes, with a maximum daily return of 0.1480 and a minimum of −0.1344, compared with IHSG's maximum of 0.0468 and minimum of −0.0823. These figures highlight Bitcoin's pronounced upside potential as well as its exposure to severe downside risk.

Table 1. Descriptive statistics of bitcoin and IHSG returns

Parameters	Bitcoin	IHSG
Mean	0.0027	0.0002
Median	0.0005	0.0009
Maximum	0.1480	0.0468
Minimum	-0.1344	-0.0823
Std. Dev	0.0319	0.0100
Observations	489	489

In terms of central tendency, Bitcoin records a higher average daily return (0.0027) than IHSG (0.0002), suggesting stronger short-term return potential. However, this higher mean return is accompanied by substantially greater volatility, implying an unfavorable risk–return trade-off from a defensive investment perspective. Both assets exhibit non-symmetric return distributions, with Bitcoin showing greater dispersion and more extreme tail behavior. Such characteristics are indicative of fat-tailed distributions commonly observed in cryptocurrency markets and contrast with the relatively more stable return profile of traditional equity indices.

The Jarque–Bera statistics further reject the null hypothesis of normality for both assets, consistent with prior evidence that cryptocurrency returns are characterized by heavy tails and asymmetric behavior (Bouri et al., 2017; Cheah & Fry, 2015). These non-normal distributional properties imply that conventional linear models assuming constant variance are insufficient to capture the underlying dynamics of the data. Preliminary volatility diagnostics (not reported for brevity) also indicate the presence of volatility clustering in both series, where periods of high volatility tend to be followed by further high volatility, justifying the use of GARCH-type models to account for time-varying conditional variance (Bollerslev, 1986; Engle, 1982).

The number of observations for both Bitcoin and IHSG totals 489, ensuring balanced samples and synchronized trading days after data alignment. This consistency allows for reliable comparative analysis and minimizes bias arising from asynchronous market activity. From a risk management perspective, the descriptive statistics already suggest that Bitcoin's return dynamics differ fundamentally from those of IHSG, characterized by greater variability and more pronounced tail risks. Such features raise initial concerns regarding Bitcoin's suitability as a stabilizing asset within equity portfolios, particularly under volatile market conditions.

Overall, the descriptive results suggest that Bitcoin continues to behave primarily as a highly volatile speculative asset rather than converging toward the risk profile of traditional financial instruments. Despite its higher average return, Bitcoin's substantially larger dispersion and extreme return realizations indicate elevated downside exposure. These preliminary findings motivate the subsequent application of DCC-GARCH to examine time-varying correlations and the use of quantile regression to assess Bitcoin's behavior under extreme market conditions, where hedge and safe-haven properties are theoretically expected to emerge (Engle, 2002; Mariana et al., 2021).

3.2 Dynamic correlation and hedge properties

Figure 1 illustrates the time-varying conditional correlations between Bitcoin and IHSG estimated using the DCC-GARCH framework. The results reveal pronounced fluctuations in dependence over time, indicating that the relationship between Bitcoin and the Indonesian equity market is highly unstable. Periods of declining correlation are observed intermittently, suggesting temporary diversification benefits; however, these episodes are short-lived and quickly followed by renewed positive co-movement. Overall, the correlation trajectory remains predominantly positive throughout the sample period, implying that Bitcoin generally moves in the same direction as the Indonesian equity market. This persistent positive dependence indicates that Bitcoin does not exhibit sustained inverse co-movement with IHSG and therefore fails to satisfy the fundamental criterion of a hedge asset, which requires a non-positive average correlation with equities (Baur & Lucey, 2010).

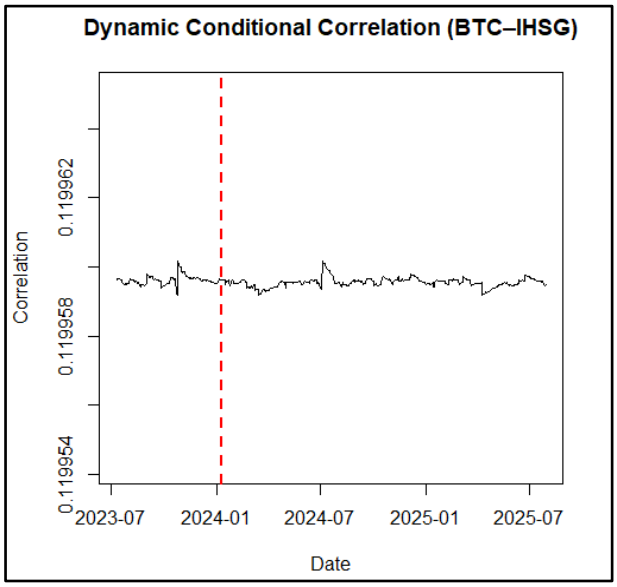

Fig. 1. Dynamic conditional correlation between bitcoin and IHSG

From an economic perspective, this unstable yet mostly positive correlation pattern reflects Bitcoin's growing integration into broader financial markets and its increasing sensitivity to global risk sentiment. Under the DCC-GARCH framework, correlations are allowed to evolve dynamically in response to volatility shocks, capturing regime shifts between tranquil and stressed market conditions (Engle, 2002). The observed co-movement suggests that during periods of heightened uncertainty, investors tend to reduce exposure to risky assets simultaneously, including both equities and cryptocurrencies, leading to synchronized price movements. This behavior is consistent with the characterization of Bitcoin as a speculative asset rather than a defensive instrument, particularly in emerging markets where retail investor dominance and momentum-driven trading amplify cross-asset contagion. The interpretation assumes that volatility clustering and information spillovers transmit shocks across markets, causing Bitcoin to respond to the same macro-financial drivers affecting IHSG. Consequently, rather than providing portfolio insulation, Bitcoin appears to participate in common risk regimes, reinforcing the conclusion that its diversification benefits are unstable and context-dependent.

Table 2. Summary of dynamic correlation results

Statistics	During all period	Before the launch of ETFs	After the launch of ETFs
Mean ρ	0.1199596	0.1199596	0.1199596
Min ρ	0.1199592	0.1199592	0.1199592
Max ρ	0.1199602	0.1199602	0.1199602
Std. Dev ρ	0.000000137	0.000000137	0.000000134

Table 2 summarizes the dynamic correlation statistics for the full sample as well as the pre-ETF and post-ETF sub-periods. The mean conditional correlation remains positive in all periods, confirming the absence of hedging properties both before and after the Spot Bitcoin Exchange-Traded Fund approval. This persistent positive dependence indicates that Bitcoin generally co-moves with IHSG rather than offsetting equity market risk. Although the post-ETF period exhibits greater variability in correlations, no structural shift toward negative dependence is detected. Instead of signaling improved diversification benefits, the increased dispersion suggests heightened sensitivity to market-wide information shocks following ETF approval. This pattern implies that growing institutional participation and enhanced accessibility may have strengthened Bitcoin's exposure to global risk sentiment, reinforcing its integration with traditional financial markets rather than decoupling it from equity dynamics.

From a portfolio perspective, these results indicate that Bitcoin's correlation structure remains unstable and regime-dependent, limiting its effectiveness as a hedge asset. While temporary declines in correlation may emerge during specific episodes, these effects are neither persistent nor sufficiently strong to provide systematic risk mitigation. The absence of negative average correlation in both sub-periods suggests that ETF-driven institutionalization does not fundamentally alter Bitcoin's role within diversified portfolios. Instead, Bitcoin appears increasingly embedded within common risk regimes affecting equities, consistent with its classification as a speculative asset rather than a defensive instrument (Bouri et al., 2017; Smales, 2019). This finding is particularly relevant in emerging market contexts such as Indonesia, where market volatility and retail investor dominance may further amplify cross-asset co-movements.

To formally assess hedge effectiveness under normal market conditions, Ordinary Least Squares regression results are reported in Table 3. The estimated coefficient on Bitcoin returns is positive and statistically insignificant, indicating that Bitcoin does not provide meaningful risk reduction for IHSG movements. Economically, a positive coefficient implies that Bitcoin tends to move in the same direction as the equity market, while the lack of statistical significance suggests that this relationship is unstable and does not deliver consistent diversification benefits. Furthermore, the interaction term between Bitcoin returns and the post-ETF dummy variable is also insignificant, indicating that the ETF introduction does not significantly change Bitcoin's sensitivity to equity market fluctuations.

Table 3. Ordinary least square hedge regression results

Variables	Estimate	P-value	Significance
Intercept (α)	0.003299	0.243	Not significant
Return IHSG (β)	0.023755	0.959	Not significant
Post ETF (θ)	-0.000816	0.803	Not significant
Ret_IHSG × PostETF (δ)	0.458151	0.344	Not significant

Taken together, these results suggest that Bitcoin's role within Indonesian equity portfolios is fundamentally limited to, at best, an unstable diversifier. Rather than providing consistent protection, Bitcoin's co-movement with IHSG reflects shared exposure to broader market sentiment and risk regimes. From a portfolio perspective, investors allocating Bitcoin alongside Indonesian equities should therefore not expect systematic risk reduction under normal market conditions. Any diversification benefits appear episodic and highly regime-dependent.

More broadly, the absence of post-ETF improvement indicates that greater institutional access and regulatory integration alone are insufficient to transform Bitcoin into a hedge asset. In emerging markets such as Indonesia, where equity volatility and sensitivity to global capital flows are already elevated, reliance on Bitcoin for portfolio protection may instead introduce additional sources of risk. These findings motivate further examination of Bitcoin's behavior during extreme downside conditions, which is addressed in the subsequent quantile regression analysis to assess potential safe-haven properties.

3.3 Safe–haven analysis and quantile regression

Safe-haven properties are examined using quantile regression at the lower quantiles (τ=0.05 and τ= 0.10), capturing extreme and moderately adverse conditions in IHSG returns, complemented by dynamic correlation summaries reported in Table 4. These approaches jointly allow assessment of Bitcoin's behavior during equity market stress, consistent with the definition of safe-haven assets as those exhibiting non-positive dependence specifically in crisis periods (Baur & Lucey, 2010; Koenker & Bassett, 1978).

Table 4. Summary of dynamic bitcoin-ihsg correlations during extreme market conditions

Quantile (τ)	Market Conditions	Observations	Mean ρ
5%	Extreme (≤ Q5)	26	0.11996
	Normal (> Q5)	463	0.11996
10%	Ekstrem (≤ Q10)	49	0.11996
	Normal (> Q10)	440	0.11996

Table 4 summarizes the average dynamic correlations between Bitcoin and IHSG during extreme and normal market conditions. The results indicate that mean conditional correlations remain positive even when IHSG returns fall into the lowest 5% and 10% quantiles. Importantly, the average correlation during extreme periods does not differ materially from that observed during normal market states. This persistence of positive dependence implies that Bitcoin continues to co-move with Indonesian equities precisely when diversification benefits are most needed. From a risk management perspective, such behavior directly contradicts the core requirement of a safe-haven asset, which should exhibit zero or negative correlation during periods of market stress. To formally test Bitcoin's sensitivity to extreme equity movements, quantile regression results are reported in Table 5.

Table 5. Quantile regression results for bitcoin safe-haven properties to IHSG

Quantile (τ)	Parameter	Estimate	P-value	Significance
5%	IHSG Return(β)	1.56190	0.15056	Not Significant
	PostETF (θ)	-0.01165	0.22689	Not Significant
	IHSG × PostETF (δ)	-0.54862	0.64893	Not Significant
10%	IHSG Return(β)	0.76667	0.51700	Not Significant
	PostETF (θ)	-0.00610	0.48772	Not Significant
	IHSG × PostETF (δ)	-0.52832	0.69621	Not Significant

The Results from Table 5 indicate that at both τ=0.05 and τ=0.10, the estimated Bitcoin coefficients (β) are positive and statistically insignificant in the pre-ETF period. This suggests that during both severe and moderate market downturns, Bitcoin does not provide protection against IHSG losses. Rather than exhibiting inverse or neutral sensitivity, Bitcoin tends to move in the same direction as equities, although with unstable magnitude. Economically, a positive β coefficient implies that negative IHSG returns are accompanied by negative Bitcoin returns, thereby amplifying portfolio losses instead of mitigating them. The lack of statistical significance further indicates that this relationship is inconsistent and regime-dependent, offering no reliable defensive benefit across extreme market states.

The post-ETF dummy coefficients (θ) and interaction terms (δ) are also statistically insignificant across both quantiles. These findings imply that the introduction of the Spot Bitcoin Exchange-Traded Fund does not materially alter Bitcoin's response to extreme equity market movements. Despite increased liquidity and broader institutional participation following ETF approval, Bitcoin does not demonstrate improved resilience during IHSG downturns. Instead, the persistence of positive dependence suggests that Bitcoin has become more tightly integrated with traditional financial markets, reducing its capacity to act as a refuge asset during crises.

From an economic standpoint, this outcome reflects Bitcoin's evolving market structure. While ETF approval enhances accessibility and legitimacy, it simultaneously facilitates stronger transmission of global risk sentiment into cryptocurrency markets. Institutional participation tends to align Bitcoin more closely with conventional asset classes, as portfolio rebalancing, margin constraints, and risk-off behavior affect equities and cryptocurrencies simultaneously. In emerging markets such as Indonesia, where equity volatility and sensitivity to external capital flows are already elevated, this integration further weakens any potential safe-haven role. Rather than decoupling during downturns, Bitcoin appears to participate in common risk regimes, resulting in synchronized price adjustments across asset classes.

These findings are consistent with prior evidence that Bitcoin often behaves as a speculative asset whose performance is closely tied to broader market sentiment, particularly during crisis episodes (Conlon & McGee, 2020; Smales, 2019). While short-lived safe-haven behavior has been documented in certain contexts, such effects are highly conditional and tend to dissipate quickly. In the Indonesian market, no such temporary protection is observed. Instead, both quantile regression and dynamic correlation results point toward persistent positive dependence, reinforcing the conclusion that Bitcoin fails to meet even the criteria of a weak safe-haven.

Importantly, the absence of post-ETF improvement challenges the expectation that regulatory integration alone can transform Bitcoin into a defensive asset. Although ETFs may contribute to greater price discovery and market efficiency, they also deepen Bitcoin's linkage with global financial cycles. As a result, Bitcoin becomes increasingly exposed to the same macroeconomic shocks, liquidity constraints, and investor sentiment shifts that drive equity market movements. This structural integration diminishes the likelihood that Bitcoin can serve as an effective refuge during periods of extreme stress.

Taken together with the findings, the safe-haven analysis confirms that Bitcoin offers limited downside protection for Indonesian equity investors. Its role is better characterized as a diversifier with unstable and regime-dependent correlations rather than as a defensive asset during market stress. From a portfolio perspective, reliance on Bitcoin as a crisis hedge may expose investors to additional risk, underscoring the importance of cautious asset allocation and the continued relevance of traditional protective instruments in emerging markets. These results highlight that, despite its growing legitimacy and institutional access, Bitcoin has yet to demonstrate the structural characteristics required to function as a reliable safe-haven asset.

3.4 Discussions and market implications

The combined results from DCC-GARCH, OLS regression, and quantile regression provide a consistent picture of the relationship between Bitcoin and the Indonesian equity market. Descriptive statistics reveal pronounced differences in asset characteristics, particularly in terms of volatility, with Bitcoin exhibiting substantially larger fluctuations than IHSG. Dynamic correlation estimates further indicate a low but persistently positive dependence, while GARCH volatility modeling confirms that Bitcoin's price movements are dominated by highly persistent volatility, in contrast to the more moderate volatility observed in IHSG. These findings suggest that Bitcoin and Indonesian equities operate under fundamentally different market dynamics, limiting the emergence of a stable structural relationship capable of providing systematic portfolio protection.

The DCC-GARCH results show that the dynamic correlation between Bitcoin and IHSG remains positive and relatively stable throughout the sample period, both before and after the introduction of the Spot Bitcoin ETF. Importantly, the correlation never enters negative territory, and variations across sub-periods are minimal. This stability within a positive range implies that Bitcoin does not adjust its co-movement with equities in a manner consistent with hedge behavior. Instead of exhibiting countercyclical dynamics during periods of market stress, Bitcoin continues to move in tandem with IHSG, albeit with low magnitude. Such behavior indicates that any diversification benefits are limited and highly

unstable, reinforcing the conclusion that Bitcoin does not function as a hedge for the Indonesian stock market.

OLS regression results further strengthen this conclusion. The estimated coefficients on Bitcoin returns are positive and statistically insignificant, both in baseline specifications and when incorporating post-ETF dummy interactions. This indicates that Bitcoin does not exert a meaningful linear influence on IHSG returns and that the ETF introduction does not generate a structural shift in their relationship. The absence of significant interaction effects suggests that enhanced institutional access following ETF approval has not altered Bitcoin's sensitivity to Indonesian equity movements. Collectively, the DCC-GARCH and OLS findings point toward a consistent outcome: Bitcoin fails to satisfy the criteria of a hedge asset under normal market conditions.

The quantile regression analysis extends these insights to extreme market states. At both $\tau=0.05$ and $\tau=0.10$, Bitcoin coefficients remain positive or statistically insignificant, implying that Bitcoin does not provide protection during severe or moderate IHSG downturns. Rather than exhibiting inverse or neutral dependence, Bitcoin tends to co-move with equities when downside risk materializes. This behavior contradicts the defining characteristic of a safe-haven asset and suggests that Bitcoin may amplify, rather than mitigate, portfolio losses during periods of market stress. The consistency of results across quantiles further indicates that Bitcoin's failure as a safe-haven is not confined to specific market conditions but persists across varying degrees of downside pressure.

These findings differ from several prior studies that document episodic safe-haven behavior for Bitcoin during extreme global crises. Such discrepancies can largely be attributed to differences in sample periods and market environments. Studies reporting temporary safe-haven characteristics often focus on periods of exceptional stress, such as the COVID-19 market collapse, where flight-to-safety dynamics may temporarily elevate demand for alternative assets. In contrast, the 2023–2025 period examined in this study is characterized by relatively more stable macro-financial conditions, without shocks comparable in magnitude to the pandemic. This suggests that Bitcoin's potential safe-haven properties are highly episodic and contingent on extraordinary market disruptions, rather than representing a persistent structural feature.

The absence of improvement following ETF approval is particularly noteworthy. While the introduction of Spot Bitcoin ETFs in January 2024 enhanced Bitcoin's legitimacy and accessibility in global markets, the empirical results indicate that these developments did not translate into improved hedge or safe-haven performance in Indonesia. Instead, ETF-driven institutionalization appears to have strengthened Bitcoin's integration with broader financial markets. Increased institutional participation may facilitate more efficient price discovery, but it also exposes Bitcoin to the same macroeconomic shocks, liquidity constraints, and shifts in global risk sentiment that influence traditional assets. As a result, Bitcoin becomes increasingly embedded within common risk regimes, reducing its capacity to decouple from equity markets during periods of stress.

The Indonesian regulatory environment further helps explain these outcomes. Although Bitcoin is increasingly treated as a financial asset globally, domestically it has historically been classified as a tradable commodity rather than a formal financial instrument for risk management purposes. Recent regulatory reforms, including the transfer of crypto-asset supervision from Bappebti (2021) to the Financial Services Authority (OJK) under Law No. 4 of 2023 and the implementation of POJK No. 27 of 2024, mark an important step toward integrating digital assets into the financial system. However, these changes are relatively recent, and their impact on investor behavior and cross-asset dynamics has not yet fully materialized within the sample period. Consequently, the structural linkage between Indonesia's crypto and equity markets remains weak, as both continue to operate under distinct regulatory regimes and risk transmission mechanisms.

Investor behavior also plays a critical role. Cryptocurrency trading in Indonesia is dominated by retail participants with relatively short investment horizons and high sensitivity to price fluctuations. Investment decisions are therefore primarily driven by expectations of capital gains rather than portfolio risk management considerations. This

speculative orientation reinforces Bitcoin's classification as a high-risk asset and contributes to its persistent volatility. As a result, Bitcoin's price dynamics are more reflective of momentum-driven trading and market sentiment than of defensive asset allocation. This behavioral pattern helps explain why Bitcoin's correlation with IHSG remains low but positive, and why it fails to transition into negative territory during periods of equity market stress.

In addition to market structure and regulation, social and normative factors further constrain Bitcoin's safe-haven potential in Indonesia. Religious perspectives that raise concerns regarding the permissibility of cryptocurrency transactions may limit participation by institutional and conservative investors. These investor groups typically play a central role in flight-to-safety behavior during crises. Their limited engagement in crypto markets reduces the likelihood of large-scale portfolio reallocations toward Bitcoin when equity markets decline, thereby weakening any potential safe-haven demand.

Overall, the results demonstrate that Bitcoin's role as a hedge or safe-haven is highly contextual and far from universal. In the Indonesian setting, Bitcoin functions primarily as a speculative asset and, at best, an unstable diversifier with regime-dependent correlations. For portfolio construction, this implies that reliance on Bitcoin for downside protection may expose investors to additional risk rather than providing meaningful insulation during market stress. Traditional defensive assets therefore remain more relevant for risk mitigation in emerging markets. Despite growing legitimacy and institutional access, Bitcoin has yet to exhibit the structural characteristics necessary to serve as a reliable hedge or safe-haven within Indonesia's financial landscape.

4. Conclusions

This study investigates whether Bitcoin functions as a hedge or safe-haven for the Indonesian stock market and examines whether the introduction of the Spot Bitcoin Exchange-Traded Fund (ETF) alters this relationship. Employing a combined DCC-GARCH, Ordinary Least Squares, and quantile regression framework, the findings consistently indicate that Bitcoin does not exhibit hedge or safe-haven characteristics with respect to the Jakarta Composite Index (IHSG). Dynamic conditional correlations remain persistently positive, OLS estimates fail to support hedging effectiveness under normal market conditions, and quantile regression results show that Bitcoin does not provide protection during extreme equity downturns. Furthermore, ETF-related interaction terms are statistically insignificant across all specifications, indicating that the approval of the Spot Bitcoin ETF in January 2024 does not generate a structural shift in Bitcoin's relationship with Indonesian equities.

These results contribute to the growing literature on cryptocurrency–equity market linkages by providing early post-ETF evidence from an emerging market context. While much of the existing research focuses on developed economies or pre-ETF dynamics, this study demonstrates that increased institutional access alone does not transform Bitcoin into a defensive asset. Instead, Bitcoin continues to behave primarily as a speculative investment with unstable and regime-dependent correlations. Although Bitcoin may occasionally offer short-lived diversification benefits, its protective role is highly contextual and fails to persist across market regimes, supporting the view that Bitcoin functions at best as an episodic diversifier rather than a consistent hedge or safe-haven.

From a practical perspective, the findings suggest that Indonesian investors should exercise caution when incorporating Bitcoin into equity portfolios for risk mitigation purposes. Rather than serving as a reliable refuge during market stress, Bitcoin appears exposed to the same systemic shocks affecting equities, potentially amplifying portfolio risk during downturns. For portfolio managers, this highlights the continued relevance of traditional defensive instruments in emerging markets. For regulators, the results underscore the importance of prudent oversight as crypto assets become more integrated into conventional financial systems, particularly in environments dominated by retail participation and elevated volatility.

Overall, this study shows that Bitcoin's role as a hedge or safe-haven is not universal but highly dependent on market conditions, regulatory structures, and investor behavior. Despite growing legitimacy and institutionalization through ETF approval, Bitcoin has yet to demonstrate the structural characteristics required to provide reliable downside protection in Indonesia. Future research may extend this analysis to longer post-ETF horizons, alternative emerging markets, or periods of severe global stress to further assess whether Bitcoin's defensive properties evolve under different macro-financial regimes.

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Author Contribution
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The data used in this study are publicly available from cryptocurrency market data providers and the Indonesia Stock Exchange (IDX). Derived datasets generated during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest
The authors declare no conflict of interest.

Declaration of Generative AI Use
All During the preparation of this work, the author used ChatGPT and Gemini to assist in language refinement and academic structuring. After using these tools, the author reviewed and edited the content as needed and took full responsibility for the content of the publication.

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