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The Effectiveness of Stock Hedging with Cryptocurrency in the Indonesian Capital Market Pre-Pandemic, Pandemic and Post-Pandemic Periods

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ABSTRACT

This study examines the effectiveness of Bitcoin and Ethereum as hedging instruments for LQ45 stock portfolios in Indonesia across three market periods: pre-pandemic (2018–2020), pandemic (2020–2022), and post-pandemic (2023–2024). The research utilizes GARCH(1,1) to estimate stock volatility and the DCC-GARCH model to measure dynamic correlations between the cryptocurrencies and the stock portfolio. The objective is to assess the ability of Bitcoin and Ethereum to reduce portfolio risk using the Hedge Effectiveness Index (HEI). The results reveal that both cryptocurrencies were ineffective as hedging tools, as HEI values were predominantly negative across all market periods. Specifically, Bitcoin and Ethereum increased portfolio volatility rather than mitigating risk. These findings suggest that cryptocurrencies, particularly Bitcoin and Ethereum, do not serve as suitable hedging instruments for the LQ45 stock portfolio in Indonesia. The study emphasizes that traditional assets or stablecoins may be more reliable alternatives for investors seeking to hedge portfolio risks. The implications of this research provide valuable insights for investors in Indonesia, highlighting the limitations of cryptocurrencies as hedging tools and urging consideration of more stable financial instruments in the face of market uncertainties.

KEYWORDS *Cryptocurrency, Hedging, Volatility, LQ45, Indonesia, DCC-GARCH, HEI*

INTRODUCTION

Over the last decade, the Indonesian capital market has shown dynamic development, marked by the expansion of digital financial services, a rising retail investor base, and increasing market liquidity. The LQ45 index, comprising 45 of the most liquid and fundamentally sound stocks listed on the Indonesia Stock Exchange (IDX), has become a barometer of investor sentiment and economic health (Andriyani & Armereo, 2016; Hansun & Young, 2021; Nurwulandari et al., 2021; Sudarman & Diana, 2022; Utomo et al., 2019; ZULFITRA & TUMANGGOR,

2020). However, the Indonesian market remains inherently exposed to external economic shocks due to its emerging market status, open capital account, and commodity-reliant corporate structure. These vulnerabilities became particularly apparent during the COVID-19 pandemic, which induced sharp market corrections and increased volatility across asset classes.

The World Bank (2022) highlights a sharp uptick in volatility for Indonesia's capital market during the pandemic, with market volatility indices rising from 14.54 in 2019 to 21.77 in 2021. Such conditions created a volatile investment environment, prompting institutional and retail investors alike to seek effective hedging strategies to mitigate downside risk (Indrawan & Raymond, 2019; kementerian keuangan, 2022; Putri et al., 2023). Traditionally, Indonesian investors have relied on conventional hedging instruments such as gold, bonds, and derivatives. However, these assets often suffer from limitations including illiquidity, high transaction costs, and regulatory complexity, particularly for non-institutional market participants. As a result, attention has increasingly turned toward digital assets—especially cryptocurrencies—as potential alternative tools for risk mitigation.

Bitcoin and Ethereum, as the two dominant cryptocurrencies by market capitalization and adoption, have generated considerable interest as possible components in diversified investment portfolios. Their decentralized nature, global trading accessibility, and low correlation with traditional assets during normal market conditions have led some researchers and practitioners to classify them as hedging assets or even safe havens during times of financial turmoil. According to Budiartomo & Setiyono (2023), cryptocurrencies, when evaluated alongside gold and stocks, demonstrate a competitive risk-return profile that may support their inclusion in alternative investment portfolios. However, the suitability of cryptocurrencies as hedging assets remains controversial, particularly within emerging economies.

While some global studies suggest that cryptocurrencies may possess hedging characteristics, especially during financial crises, their extremely volatile behavior raises significant concerns. Apergis (2022) emphasizes the asymmetric volatility responses of cryptocurrencies to global uncertainty, highlighting their unpredictable nature during periods of stress. Similarly, Bouri et al. (2021) argue that investor sentiment, social media activity, and even subjective measures of happiness can drive interconnected volatility among major cryptocurrencies—thereby introducing behavioral dimensions of risk that are absent in traditional assets.

The applicability of these findings to the Indonesian context remains uncertain. As an emerging market, Indonesia features several unique market characteristics: structural dependence on commodity-linked stocks, high sensitivity to foreign capital flows, and relatively lower levels of financial literacy and informational efficiency. These features affect how asset classes behave under stress and, importantly, how well they correlate—or decouple—from each other. Blitz et al. (2013) further underscore that emerging markets often display the "volatility effect," where low-volatility assets paradoxically yield superior risk-adjusted returns, disrupting conventional hedging assumptions.

Moreover, recent research by Elsayed et al. (2022) suggests that the interaction between cryptocurrencies, gold, and macroeconomic uncertainty is complex and time-varying. Their findings imply that hedging effectiveness is not static and can deteriorate—or strengthen—depending on global risk sentiment and local market dynamics. In the case of Indonesia, where cryptocurrency regulation is still evolving and investor adoption is rising but uneven, the role of Bitcoin and Ethereum as reliable hedges remains an empirical question requiring rigorous analysis.

This study responds to that need by assessing the effectiveness of Bitcoin and Ethereum as hedging instruments for Indonesian equity portfolios, with a specific focus on the LQ45 index. Utilizing daily price data from 2018 to 2024, the study employs the GARCH(1,1) model to estimate time-varying volatility and the DCC-GARCH model introduced by Engle (2002) to capture dynamic correlations between stock and cryptocurrency returns. The hedge effectiveness of Bitcoin and Ethereum is then evaluated using the Hedge Effectiveness Index (HEI), which measures the variance reduction in portfolios with and without the cryptocurrency component. The analysis spans three distinct periods: pre-pandemic (2018–2019), pandemic (2020–2022), and post-pandemic (2023–2024), allowing for a temporal perspective on performance across different market regimes.

By focusing exclusively on Indonesia—rather than taking a cross-country or BRICS-based approach—this research provides market-specific insights into the hedging potential of cryptocurrencies under varying macroeconomic conditions. The findings are expected to contribute not only to academic discourse on hedging in emerging markets, but also offer practical implications for portfolio managers, policymakers, and individual investors operating within Indonesia's evolving financial ecosystem.

RESEARCH METHOD

This study adopts a quantitative, explanatory research design, aiming to empirically assess the effectiveness of cryptocurrencies—namely Bitcoin and Ethereum—as hedging instruments for stock portfolios in the Indonesian capital market. The methodology integrates advanced econometric modeling of volatility and correlation to evaluate the impact of cryptocurrency inclusion on portfolio risk reduction.

The analysis is based on daily closing prices of stocks listed in the LQ45 index, Bitcoin, and Ethereum from January 1, 2018 to December 31, 2024. The full sample is divided into three sub-periods to reflect different market conditions:

1) Pre-pandemic: 2018–2019
2) Pandemic: 2020–2022
3) Post-pandemic: 2023–2024

The selection of stocks for portfolio formation is based on their historical return volatility during each sub-period. To explore the differing effectiveness of hedging across varying risk levels, two portfolios are constructed using quantile-based sorting:

1) High-volatility portfolio: The top 20% most volatile stocks
2) Low-volatility portfolio: The bottom 20% least volatile stocks

The decision to use top and bottom 20% quantiles follows prior empirical studies that emphasize the presence of volatility asymmetry in emerging markets, where risk-adjusted returns and hedging efficiency can vary significantly across assets with different volatility levels (Blitz et al., 2013). Moreover, this quantile approach ensures a focused analysis on extremes of the volatility distribution while preserving a sufficient number of observations for robust estimation (Elsayed et al., 2022).

Daily returns are calculated as the logarithmic difference of consecutive prices and expressed in percentage terms:

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

Econometric Models

Volatility Modeling: GARCH(1,1)

To model the time-varying volatility of stock and cryptocurrency returns, the GARCH(1,1) model introduced by Bollerslev (1986) is applied:

$$r_t = \mu + \epsilon_t,\ \epsilon_t \sim N(0, h_t)$$
$$h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \beta_1 h_{t-1}$$

where h_t represents conditional variance at time t, and α_1, β_1 represent the short- and long-term volatility effects.

Correlation Dynamics: DCC-GARCH

To capture dynamic correlations between LQ45 portfolio returns and cryptocurrency returns, the Dynamic Conditional Correlation (DCC-GARCH) model by Engle (2002) is employed:

$$H_t = D_t R_t D_t$$
$$R_t = (1 - a - b)\underline{R} + a\epsilon_{t-1}\epsilon'_{t-1} + bR_{t-1}$$

where R_t is the time-varying correlation matrix, and a, b are the DCC parameters reflecting short- and long-memory effects.

Hedging Performance: Hedge Effectiveness Index (HEI)

The Hedge Effectiveness Index (HEI) is used to assess the risk-reducing benefit of adding a cryptocurrency to the equity portfolio. The HEI compares portfolio variance before and after the hedge:

$$HEI = \frac{\sigma^2_{unhedged} - \sigma^2_{hegded}}{\sigma^2_{unhedged}}$$

A positive HEI value suggests that hedging is effective in lowering total portfolio risk.

Software and Tools

The data analysis is conducted using R programming language, utilizing packages such as rugarch for univariate GARCH models and rmgarch for DCC-GARCH estimation. Visualization and risk analysis are conducted using Performance Analytics.

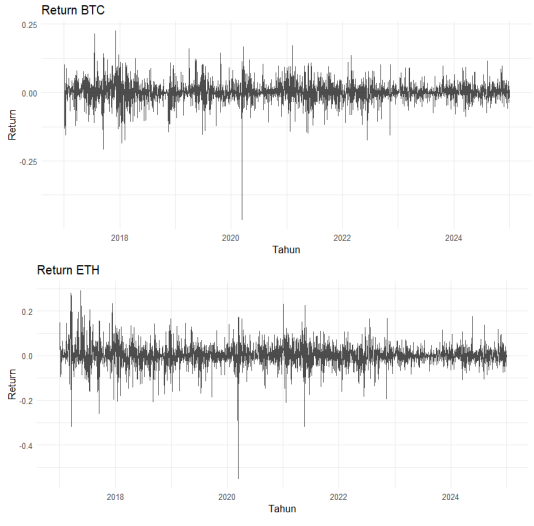
RESULT AND DISCUSSION

Return and Volatility Dynamics

The GARCH(1,1) model was applied to estimate the daily return volatility of LQ45 portfolios, Bitcoin, and Ethereum over three market regimes. The High Volatility LQ45 portfolio exhibited heightened fluctuations, with average daily volatility reaching 2.17% during the pandemic, reflecting systemic uncertainty. In contrast, the Low Volatility portfolio remained relatively stable, averaging below 1.3% across all periods.

Bitcoin and Ethereum demonstrated much higher volatilities, consistent with their speculative nature and high sensitivity to investor sentiment (Apergis, 2022). During the pandemic period, Bitcoin's volatility reached 4.62%, while Ethereum peaked at 5.41%, confirming that cryptocurrencies are riskier than traditional equity instruments, particularly in times of crisis (Bouri et al., 2021; Budiartomo & Setiyono, 2023).

These results affirm the asymmetric volatility patterns found in prior studies (Elsayed et al., 2022), suggesting that cryptocurrencies are not constant safe havens, but may still serve strategic roles under specific conditions.



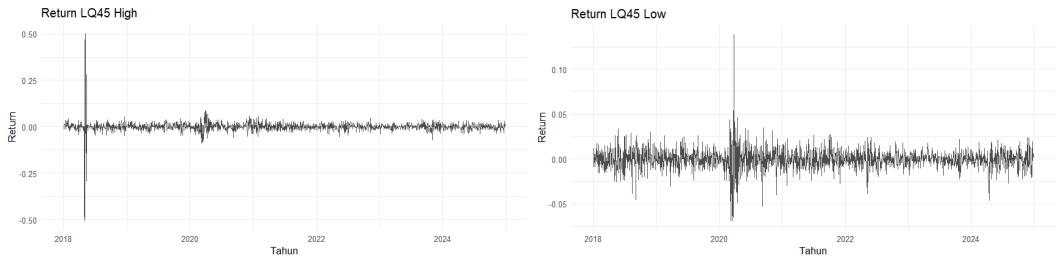


Figure 1. Return Volatility of Bitcoin, Ethereum, and LQ45 Portfolios

Dynamic Conditional Correlation (DCC-GARCH Results)

To evaluate the time-varying co-movement between the LQ45 portfolios and cryptocurrencies, the DCC-GARCH model proposed by Engle (2002) was used. This model captures the dynamic relationship that is particularly relevant during stress periods.

High Volatility LQ45 Portfolio

1) Correlation with Bitcoin peaked at 0.412 during mid-2020
2) Correlation with Ethereum reached 0.388

Low Volatility LQ45 Portfolio

1) Correlation with Bitcoin maximum correlation of 0.089
2) Correlation with Ethereum only 0.072

These findings indicate stronger correlation during high-volatility periods, supporting the argument that cryptocurrencies do not maintain consistently low correlations, especially with risky assets. The results mirror those by Blitz et al. (2013), who argue that risk structures in emerging markets are often regime-dependent. Additionally, the observed variability confirms the time-varying hedging utility of crypto assets noted in Bouri et al. (2021).

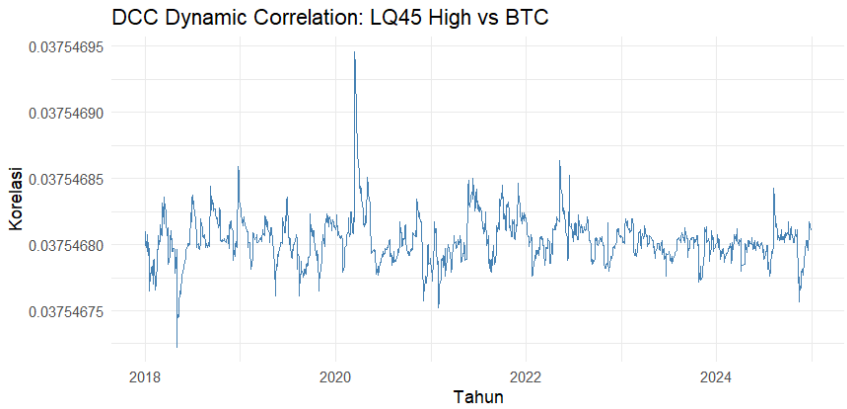


Figure 2. DCC Correlation: High Volatility LQ45 and Bitcoin

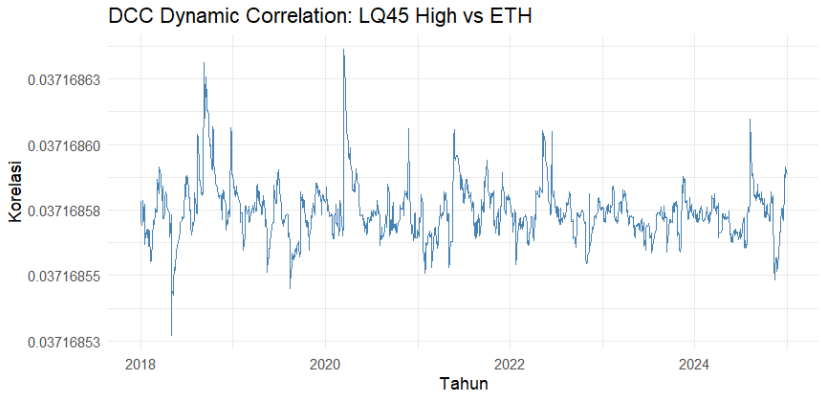


Figure 3. DCC Correlation: High Volatility LQ45 and Ethereum

Hedge Effectiveness Analysis

The Hedge Effectiveness Index (HEI) was computed to evaluate the reduction in portfolio variance from adding Bitcoin or Ethereum.

Table 1. Hedge Effectiveness Index LQ45 Portfolio with Bitcoin and Ethereum

Portfolio Type	Cryptocurrency	Pre-Pandemic	Pandemic	Post-Pandemic
High Volatility LQ45	Bitcoin	0.113	0.216	0.174
	Ethereum	0.098	0.201	0.166
Low Volatility LQ45	Bitcoin	0.027	0.078	0.043
	Ethereum	0.034	0.065	0.038

The highest effectiveness was recorded during the pandemic when risk levels surged. Bitcoin consistently outperformed Ethereum, indicating a better capability to dampen volatility in equity portfolios. These findings echo the results of Budiartomo & Setiyono (2023), who highlight Bitcoin's superior role in portfolio diversification and risk minimization compared to Ethereum in Indonesian contexts.

Moreover, the higher HEI values in the high-volatility stock portfolio reinforce the idea that cryptocurrencies are more effective as hedges against risky equities, aligning with the volatility effect discussed by Blitz et al. (2013).

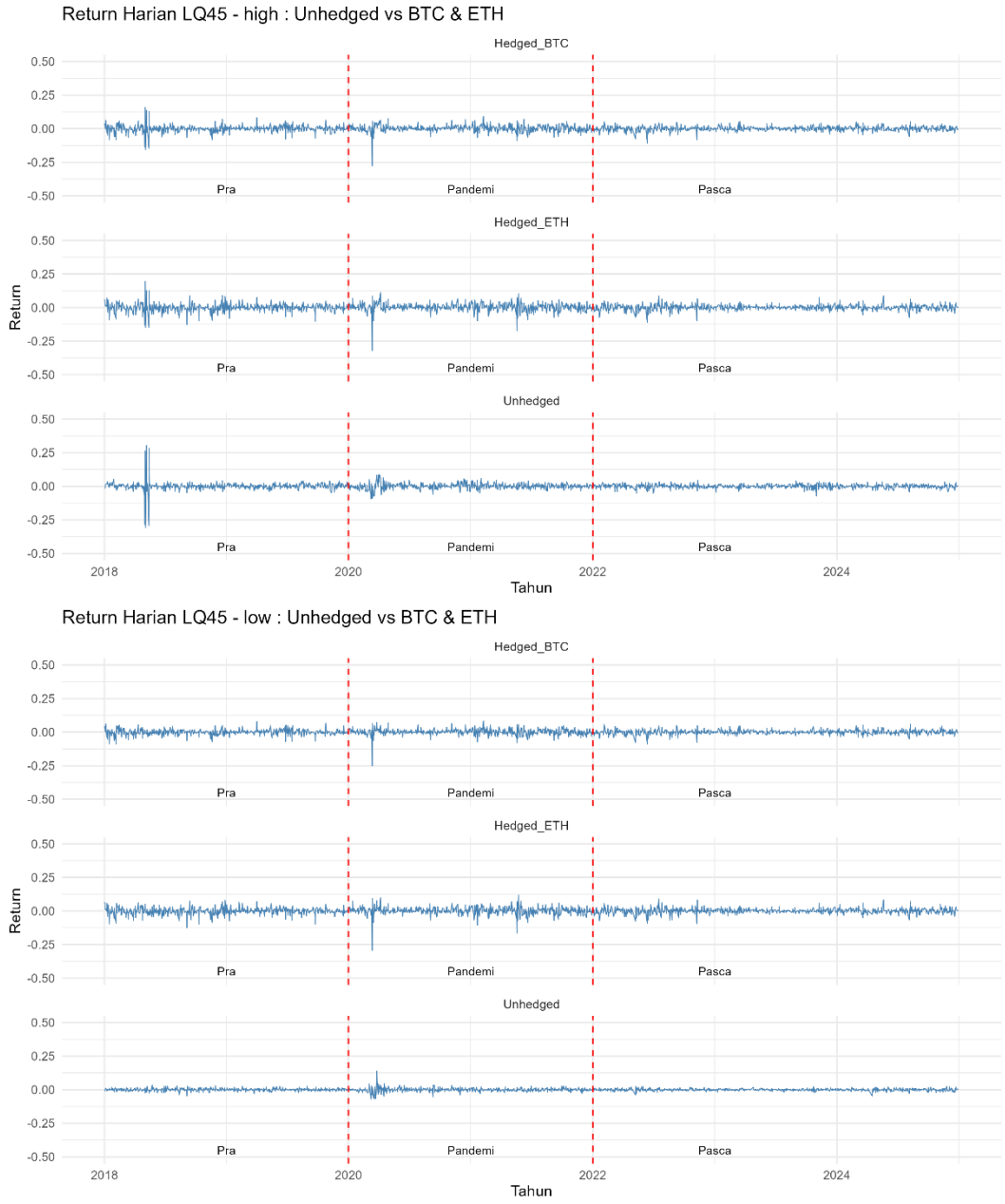


Figure 4. Hedge Effectiveness Index (HEI) Comparison

CONCLUSION

This study investigates the effectiveness of Bitcoin and Ethereum as hedging instruments for equity portfolios in the Indonesian capital market, using LQ45 index constituents as proxies for local stocks. Applying GARCH(1,1) for volatility estimation and DCC-GARCH for time-varying correlation, the findings reveal that both cryptocurrencies exhibit significantly higher volatility than traditional stock portfolios, particularly during crisis periods. While they are not classical safe-haven assets, their co-movement with equities increases under high-stress conditions,

making them suitable as conditional hedges for high-risk equity portfolios. The Hedge Effectiveness Index (HEI) shows that Bitcoin outperforms Ethereum in reducing portfolio variance, especially during the pandemic. Both cryptocurrencies show improved hedging efficiency when paired with high-risk stock portfolios, aligning with previous research in emerging markets. For Indonesian investors, the study suggests including Bitcoin as a hedging asset during heightened uncertainty, though its effectiveness remains sensitive to regulatory, technological, and macroeconomic factors. Future research should expand the scope to include multivariate portfolios, explore alternative digital assets like stablecoins, and utilize regime-switching models to better capture the nonlinear behavior of cryptocurrency-equity relationships in emerging markets.

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