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**INTERMARKET INFLUENCE BETWEEN TRADITIONAL STOCK MARKETS AND
CRYPTOCURRENCIES: A CASE STUDY OF JSX AND BTC**

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Abstract. This study explores the intermarket dynamics between the Jakarta Stock Exchange Composite Index (JSX) and Bitcoin (BTC), focusing on their behavior during periods of market stress, such as the COVID-19 pandemic. Using historical data from 2017 to 2024, the research employs volatility analysis, Vector Autoregression (VAR) models, and correlation analysis to investigate the volatility spillovers and interdependencies between these two distinct markets. The findings reveal that BTC exhibits significantly higher volatility compared to JSX and USD/IDR, underscoring its high-risk nature. The study also uncovers that while volatility spillovers from JSX to BTC are present, the reverse is less pronounced, suggesting that traditional stock markets can influence cryptocurrency markets during periods of economic stress. The results have important implications for investors, highlighting the need for careful risk management and portfolio diversification strategies, especially in emerging markets like Indonesia.

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Abstrak. Penelitian ini mengeksplorasi dinamika intermarket antara Indeks Harga Saham Gabungan (IHSG) Jakarta dan Bitcoin (BTC), dengan fokus pada perilaku mereka selama periode stres pasar, seperti pandemi COVID-19. Dengan menggunakan data historis dari tahun 2017 hingga 2024, penelitian ini menerapkan analisis volatilitas, model Vector Autoregression (VAR), dan analisis korelasi untuk menyelidiki spillover volatilitas dan interdependensi antara dua pasar yang berbeda ini. Temuan menunjukkan bahwa BTC menunjukkan volatilitas yang jauh lebih tinggi dibandingkan dengan IHSG dan USD/IDR, menegaskan sifat risiko tinggi dari cryptocurrency. Studi ini juga mengungkapkan bahwa meskipun terdapat spillover volatilitas dari IHSG ke BTC, pengaruh sebaliknya kurang menonjol, menunjukkan bahwa pasar saham tradisional dapat memengaruhi pasar cryptocurrency selama periode stres ekonomi. Hasil penelitian ini memiliki implikasi penting bagi investor, menyoroti perlunya pengelolaan risiko dan strategi diversifikasi portofolio yang cermat, terutama di pasar negara berkembang seperti Indonesia.

INTRODUCTION

In recent years, global financial markets have undergone significant transformations, particularly with the emergence of digital assets such as cryptocurrencies. The rapid growth of cryptocurrencies has not only introduced a new asset class but has also reshaped the dynamics of traditional financial systems. The market capitalization of cryptocurrencies surged dramatically, highlighting their increasing importance in the global financial landscape (Ji et al., 2019). This exponential growth has prompted both investors and regulators to reassess their strategies and frameworks in response to the unique challenges posed by these digital assets.

The rise of cryptocurrencies has introduced complexities into the financial system, necessitating enhanced regulatory oversight to mitigate associated risks (Gao, 2023). As digital currencies proliferate, traditional financial institutions are compelled to adapt, integrating these new forms of currency into their operations while managing the risks they entail (Peace, 2023). The interconnectedness of traditional markets and cryptocurrencies has been empirically established, indicating that fluctuations in cryptocurrency values can impact traditional financial instruments (Shi, 2023).

Moreover, the advent of Central Bank Digital Currencies (CBDCs) represents a strategic response by governments to the challenges posed by private cryptocurrencies. CBDCs aim to provide a stable digital currency alternative that can coexist with existing financial systems while ensuring monetary policy effectiveness and financial stability (Tang, 2023; Opare & Kim, 2020). The exploration of CBDCs has gained momentum as central banks seek to harness the benefits of digital currencies while mitigating the risks associated with private sector innovations (Tang, 2023).

The implications of these developments extend beyond mere market dynamics; they encompass broader economic and societal impacts. The integration of digital currencies into the financial ecosystem has the potential to enhance transaction efficiency and reduce costs, but it also raises concerns regarding financial stability and regulatory compliance (He, 2023; Zhao, 2022). As digital currencies continue to gain traction, stakeholders must navigate the complexities of this evolving landscape, balancing innovation with the need for robust regulatory frameworks to safeguard against potential risks (Krishna, 2023; Naheem, 2018).

In conclusion, the evolution of global financial markets in recent years, particularly with the rise of digital assets like cryptocurrencies, has been profound. The interplay between traditional financial systems and emerging digital currencies necessitates ongoing research and adaptation by regulators, financial institutions, and investors alike. As the landscape continues to evolve, understanding the implications of these changes will be crucial for ensuring a stable and efficient financial future.

The exponential growth of cryptocurrencies in recent years can be attributed to several interrelated factors. Firstly, the decentralized nature of cryptocurrencies, particularly Bitcoin, has appealed to individuals seeking alternatives to traditional banking systems. This decentralization allows for

peer-to-peer transactions without intermediaries, which enhances privacy and reduces transaction costs (Albrecht et al., 2019; Kayani, 2024). Additionally, the rise of blockchain technology has provided a secure and transparent framework for cryptocurrency transactions, further driving interest and adoption (Galant, 2024; Cumming et al., 2019). The increasing skepticism towards traditional financial institutions, especially following the 2008 financial crisis, has also fueled demand for cryptocurrencies as a hedge against systemic risks (Wang, 2024). Furthermore, the proliferation of Initial Coin Offerings (ICOs) and the introduction of various altcoins have expanded investment opportunities, attracting a diverse range of investors (Aliyu et al., 2020; Arias-Oliva et al., 2019).

The integration of cryptocurrencies into the broader financial ecosystem has been marked by their acceptance among institutional investors and the development of financial products such as Bitcoin futures and exchange-traded funds (ETFs) (Jackon, 2024). This acceptance has been facilitated by regulatory clarity and the establishment of infrastructure that supports cryptocurrency trading and custody (Jackon, 2024; Feinstein & Werbach, 2021). The emergence of Decentralized Finance (DeFi) has also played a crucial role in this integration, as it leverages blockchain technology to offer financial services without traditional intermediaries, thus challenging conventional banking practices (Decentralized Finance, 2024).

Studying the interconnections between traditional stock markets and cryptocurrencies is crucial for several reasons. Firstly, understanding these relationships can help investors and policymakers assess the systemic risks posed by cryptocurrencies, particularly as they become more integrated into the financial system (Li & Huang, 2020). The volatility of cryptocurrency markets can spill over into traditional markets, potentially exacerbating financial instability (Li & Huang, 2020; Caferra & Vidal-Tomás, 2021). Conversely, cryptocurrencies may also offer diversification benefits for investors, as they often exhibit different performance patterns compared to traditional assets (Sanusi & Dickason-Koekemoer, 2022; Liu et al., 2020).

The risks associated with these interconnections include increased market volatility and the potential for regulatory challenges as authorities grapple with the implications of cryptocurrencies on financial stability (Li & Huang, 2020). Moreover, the speculative nature of cryptocurrencies can lead to significant financial losses for investors, particularly those lacking adequate financial literacy (Zhao & Zhang, 2021; Shahzad, 2024). On the other hand, the opportunities presented by these interconnections include the potential for enhanced liquidity in financial markets and the creation of innovative financial products that cater to the evolving needs of investors (Jackon, 2024; Feinstein & Werbach, 2021). As the landscape continues to evolve, ongoing research and analysis will be essential to navigate the complexities of these interconnections effectively.

The interaction between the Jakarta Stock Exchange (JSX) and Bitcoin (BTC) presents an underexplored area in the current literature, revealing several gaps that warrant further investigation. One significant gap is the lack of empirical studies specifically addressing the correlation and causation between JSX and BTC, particularly in the context of emerging markets like Indonesia. Most existing research tends to focus on developed markets, leaving a void in

understanding how cryptocurrencies interact with stock markets in developing economies (Gil-Alana et al., 2020). Additionally, while some studies have examined the volatility spillover effects between cryptocurrencies and traditional financial assets, there is limited research that delves into the specific mechanisms through which these interactions influence investor behavior and market dynamics in the Indonesian context (Surana, 2023).

Addressing these gaps is crucial for several reasons. First, understanding the relationship between JSX and BTC can provide valuable insights for investors and policymakers in Indonesia, particularly as cryptocurrencies gain traction as alternative investment vehicles. This understanding can help in formulating regulatory frameworks that ensure market stability while fostering innovation (Regulatory Cooperation in the Crypto Sphere, 2024). Moreover, as cryptocurrencies continue to evolve, their potential impact on traditional financial markets, including JSX, necessitates a comprehensive analysis to mitigate risks associated with increased volatility and speculative trading behavior (Conlon et al., 2020).

The volatility spillovers between cryptocurrency markets and traditional stock markets can significantly affect investor behavior and market stability. High volatility in one market can lead to increased uncertainty in another, prompting investors to adjust their portfolios in response to perceived risks (Kawaguchi & Noda, 2022). For instance, during periods of heightened volatility in the cryptocurrency market, investors may exhibit herding behavior, leading to synchronized trading patterns that exacerbate market fluctuations (Arora & Rajendran, 2023). This herding behavior can result in a feedback loop where volatility in the cryptocurrency market spills over into the stock market, further amplifying price swings and potentially destabilizing investor sentiment (Surana, 2023).

Conversely, the integration of cryptocurrencies into traditional financial markets can also present opportunities for diversification. Investors may seek to include cryptocurrencies in their portfolios to hedge against risks associated with traditional assets, particularly during times of economic uncertainty (Conlon et al., 2020). However, the speculative nature of cryptocurrencies means that while they can provide diversification benefits, they can also introduce additional risks, particularly if investors lack adequate knowledge and understanding of these digital assets (Regulatory Cooperation in the Crypto Sphere, 2024). Therefore, it is essential to study these interconnections to develop strategies that enhance market stability while capitalizing on the potential benefits of cryptocurrency investments.

LITERATURE REVIEW

The Evolution of Financial Markets with the Rise of Cryptocurrencies

The evolution of financial markets has been significantly influenced by the advent of cryptocurrencies, which have introduced new dynamics into the global financial system. Cryptocurrencies, especially Bitcoin, have transitioned from niche technological innovations to mainstream financial assets, with their market capitalization and trading volumes rivaling those of

traditional financial instruments (Ji et al., 2019). This transition has prompted extensive academic inquiry into the implications of cryptocurrencies for financial stability, regulatory frameworks, and market behavior (Gao, 2023).

The literature reveals that the rise of cryptocurrencies has been driven by factors such as technological innovation, regulatory developments, and changing investor preferences (Albrecht et al., 2019). Blockchain technology, which underpins cryptocurrencies, has provided a decentralized and secure platform for transactions, reducing the need for intermediaries and offering enhanced transparency (Cumming et al., 2019). Additionally, the post-2008 financial crisis environment, characterized by distrust in traditional financial institutions, has led investors to seek alternative assets, further boosting the adoption of cryptocurrencies (Wang, 2024).

Furthermore, the integration of cryptocurrencies into the broader financial ecosystem has been facilitated by the development of financial products such as Bitcoin futures and exchange-traded funds (ETFs) (Jackson, 2024). These products have bridged the gap between traditional and digital assets, allowing institutional investors to participate in the cryptocurrency market while managing risks through established financial instruments (Feinstein & Werbach, 2021). The rise of Decentralized Finance (DeFi) has also played a critical role, challenging conventional banking practices by offering financial services without traditional intermediaries (Decentralized Finance, 2024).

2.2 Volatility in Traditional Stock Markets and Cryptocurrencies

Volatility is a central theme in financial markets, and the literature extensively covers its role in both traditional stock markets and cryptocurrencies. Traditional stock market volatility is influenced by a range of factors, including macroeconomic indicators, geopolitical events, and market sentiment (Trabelsi, 2018). In emerging markets like Indonesia, stock market volatility tends to be higher due to factors such as lower liquidity, greater sensitivity to external shocks, and the presence of retail investors (Hu, 2016).

In contrast, cryptocurrency markets exhibit even greater volatility, driven by factors such as speculative trading, regulatory news, and technological developments (Asgharian et al., 2013). The decentralized nature of cryptocurrencies, combined with their relatively nascent stage, leads to price swings that are more pronounced than in traditional financial markets (Senarathne & Jiang, 2020). This high volatility presents both challenges and opportunities for investors, necessitating a nuanced understanding of how cryptocurrencies behave compared to traditional assets.

2.3 Volatility Spillovers Between Traditional and Cryptocurrency Markets

The concept of volatility spillovers is critical to understanding the interconnectedness of financial markets. The literature indicates that volatility spillovers between traditional stock markets and cryptocurrency markets are increasingly relevant as these asset classes become more integrated (Aydogan et al., 2022). For instance, studies have shown that during periods of market stress,

volatility in traditional markets can spill over into cryptocurrency markets, and vice versa, influencing investor behavior and market stability (Caferra & Vidal-Tomás, 2021).

Research has also explored the bidirectional nature of these spillovers, where shocks in one market can lead to increased volatility in another. For example, during periods of heightened volatility in the cryptocurrency market, traditional stock markets may experience correlated price movements as investors adjust their portfolios in response to perceived risks (Harb et al., 2022). Conversely, volatility in stock markets can impact cryptocurrency prices, particularly in emerging markets where financial systems are less developed (Surana, 2023).

2.4 Gaps in the Literature

Despite the growing body of research on the interaction between traditional and cryptocurrency markets, several gaps remain. There is a notable lack of empirical studies focusing on the relationship between JSX and BTC, particularly in the context of emerging markets like Indonesia (Gil-Alana et al., 2020). Most existing studies have concentrated on developed markets, leaving a gap in understanding how cryptocurrencies interact with stock markets in developing economies (Çevik et al., 2018).

Additionally, while the literature has begun to address volatility spillovers, there is limited research on the specific mechanisms through which these spillovers influence investor behavior and market dynamics in the Indonesian context (Surana, 2023). Addressing these gaps is crucial for developing a comprehensive understanding of how cryptocurrencies and traditional stock markets interact, particularly in emerging markets where financial systems are still evolving.

METHODOLOGY

3.1 Data Collection

The study draws on historical data from three key financial instruments: the Jakarta Stock Exchange Composite Index (JSX), Bitcoin (BTC) priced in Indonesian Rupiah (IDR), and the USD/IDR exchange rate. This data spans a period from 2017 to 2024, offering a comprehensive perspective on market dynamics during this timeframe. The selection of these datasets enables a detailed examination of the interactions between traditional financial markets and the emerging cryptocurrency market within the context of an Indonesian framework.

The historical data for the JSX Composite Index was sourced from Investing.com, a widely recognized financial platform. This data provides insights into the performance of the Indonesian stock market over the selected period, which is crucial for understanding its volatility and relationship with other financial instruments. Similarly, the data for Bitcoin, priced in IDR, was obtained from the same platform, ensuring consistency and reliability in the data sources. This BTC/IDR dataset is vital for analyzing how cryptocurrency, as a digital asset, interacts with traditional financial markets like JSX. Lastly, the USD/IDR exchange rate data, also retrieved from

Investing.com, offers a view into the currency fluctuations that could impact both the stock market and cryptocurrency values.

These datasets, which include daily closing prices, form the foundation for calculating returns and conducting in-depth volatility analyses. By focusing on daily data, the study ensures a granular view of market movements, allowing for a more accurate assessment of volatility patterns and intermarket influences during the study period.

3.2 Volatility Analysis

The volatility of JSX, BTC, and USD/IDR is analyzed using several statistical measures. The standard deviation of daily returns serves as a primary indicator of market risk. To account for the time-varying nature of volatility, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is employed. This model captures the clustering of volatility, a common feature in financial markets, allowing for a more nuanced understanding of market dynamics.

The GARCH model is applied individually to each asset to estimate conditional volatility over the study period. This approach helps identify periods of heightened risk, particularly during market downturns such as the COVID-19 pandemic. The results are presented in the form of time series plots, providing a visual representation of volatility trends.

3.3 Volatility Spillover Analysis

To explore the interconnections between JSX, BTC, and USD/IDR, a Vector Autoregression (VAR) model is used to analyze volatility spillovers. The VAR model is suitable for examining the dynamic relationships between multiple time series, enabling the study to assess how shocks in one market influence volatility in others.

Impulse response functions (IRFs) are derived from the VAR model to illustrate the effect of shocks in one market on another over time. Additionally, Granger causality tests are conducted to determine whether past values of one asset can predict future volatility in another, providing insights into the directionality of these relationships.

The study also computes the spillover index, which quantifies the extent to which volatility in one market can be attributed to shocks from other markets. This index provides a comprehensive view of the interdependence between the studied assets.

3.4 Intermarket Correlation Analysis

The correlation between the returns of JSX, BTC, and USD/IDR is examined to assess the degree of interdependence between these markets. Correlation coefficients are calculated using rolling windows, allowing for an analysis of how these relationships evolve over time.

Special attention is given to periods of market stress, such as the COVID-19 pandemic, to understand how correlations change under different market conditions. The results are visualized using heatmaps, which depict the strength and direction of the correlations across the assets.

3.5 Robustness Checks

To ensure the reliability of the results, several robustness checks are performed. The analysis is repeated with different lag lengths in the VAR and Granger causality models to test the sensitivity of the findings to model specifications. Alternative measures of volatility, such as realized volatility, are also used to validate the results.

Furthermore, the study compares results across different sample periods, particularly focusing on sub-samples before and after significant market events, to ensure that the findings are consistent and not driven by specific time periods.

ANALYSIS

4.1 Volatility Analysis

The volatility analysis during the market crash period from February 20, 2020, to March 23, 2020, reveals distinct differences in the behavior of the Jakarta Stock Exchange Composite Index (JSX), Bitcoin (BTC), and the USD/IDR exchange rate. This analysis provides a comprehensive look at the risk profiles of these assets and their responses to the extreme market conditions triggered by the COVID-19 pandemic. By examining the volatility levels of each asset during this period, the study highlights the varying degrees of risk associated with these financial instruments.

The annualized volatility for each asset was calculated to quantify the risk associated with their respective returns during the market crash. The results showed that the JSX had an annualized volatility of 15.96%, while BTC exhibited a significantly higher volatility of 66.41%. In contrast, the USD/IDR exchange rate displayed a much lower volatility of 7.78%. These figures underscore the extreme risk associated with Bitcoin, a characteristic consistent with the general perception of cryptocurrencies as highly volatile assets. The daily returns of BTC displayed much larger price swings compared to the more stable returns of the JSX and USD/IDR, reflecting the high-risk nature of cryptocurrency investments.

During the COVID-19 market crash, all three assets experienced heightened volatility, but the degree of this volatility varied. Bitcoin's volatility was particularly pronounced, reflecting its heightened sensitivity to market stress and its role as a speculative asset. The JSX also showed increased volatility, though to a lesser extent than BTC, indicating its relatively more stable nature. The USD/IDR exchange rate, on the other hand, remained relatively stable during this period, with less pronounced volatility compared to the other two assets. To provide a clearer understanding of the performance of these assets during the market crash, the analysis was further explored using log-scaled asset performance and standard price performance graphs. The log-scaled asset performance graph offers a comparative view of the relative performance of JSX, BTC, and USD/IDR during the market crash.

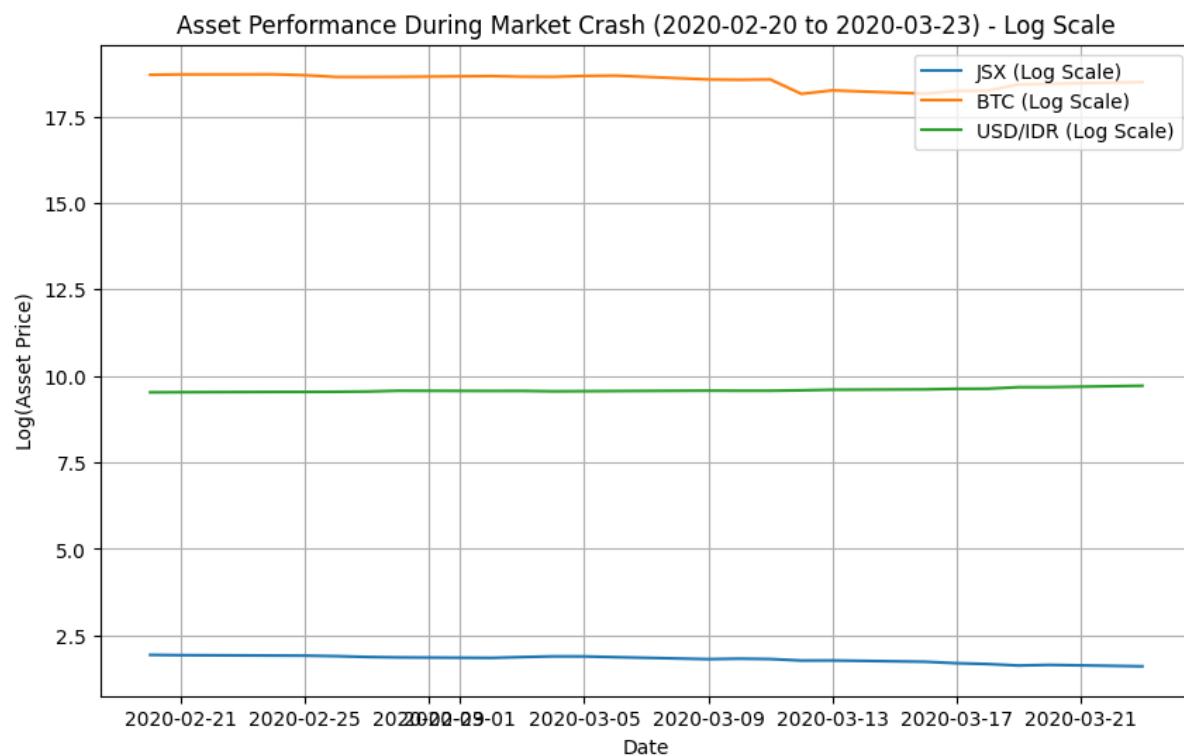


Figure 1: Log Scaled Asset Performance During Market Crash

In this graph, BTC, represented by the orange line, shows a relatively stable trend with a slight downward movement, indicating some decline during this period. Despite this decline, BTC remains the highest in terms of log-scaled price, highlighting its significant price level even amid market turbulence. The JSX, shown by the blue line, demonstrates similar stability with a slight downward trend but remains at a lower log-scale level compared to BTC.

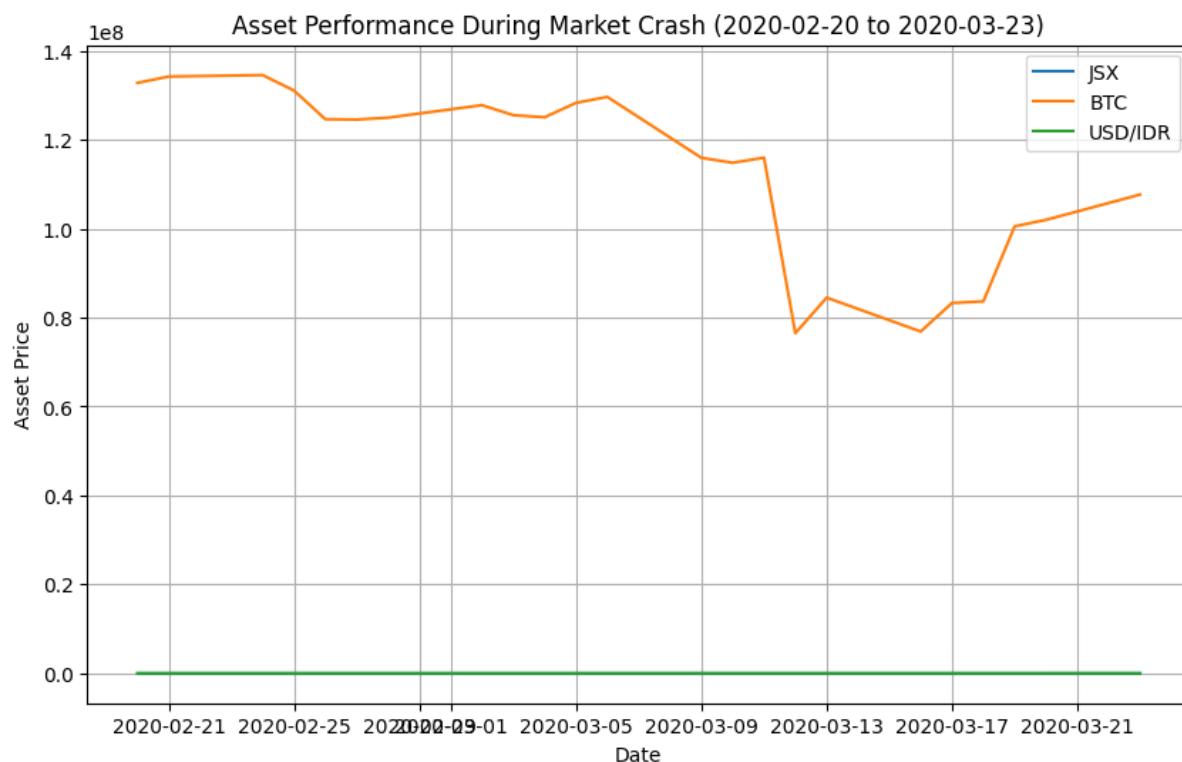


Figure 2: Nominal Asset Performance During Market Crash

Meanwhile, the USD/IDR, depicted by the green line, appears mostly flat in the log-scale, suggesting that it experienced less relative movement compared to the other two assets during the crash. This detailed examination of asset volatility during the COVID-19 market crash provides valuable insights into the varying risk profiles of different financial instruments. It highlights the extreme volatility associated with cryptocurrencies like Bitcoin and the relatively more stable nature of traditional assets such as the JSX and the USD/IDR exchange rate, particularly in times of market stress.

4.2 Volatility Spillover Analysis

The volatility spillover analysis between the Jakarta Stock Exchange Composite Index (JSX), Bitcoin (BTC), and the USD/IDR exchange rate was conducted using a Vector Autoregression (VAR) model, Impulse Response Functions (IRF), and a Volatility Spillover Matrix. The results reveal the extent of interconnectedness between these markets and how volatility in one market can affect the others.

The Impulse Response Functions (IRF) illustrate the reaction of each market's volatility to shocks in the volatility of other markets over a 10-day forecast horizon. The results show that a shock in JSX volatility gradually diminishes over time as the market stabilizes, indicating that JSX volatility is primarily self-contained. Conversely, a shock in BTC volatility shows a minor but increasing impact on JSX volatility, suggesting that volatility in the cryptocurrency market can spill over into the traditional stock market, albeit weakly. When considering the effect of a shock in JSX volatility

on BTC, the impact is immediate and positive, indicating that movements in the traditional stock market can significantly influence the volatility in the cryptocurrency market. Similarly, the impact of a BTC volatility shock on BTC itself diminishes over time, mirroring the behavior observed in JSX.

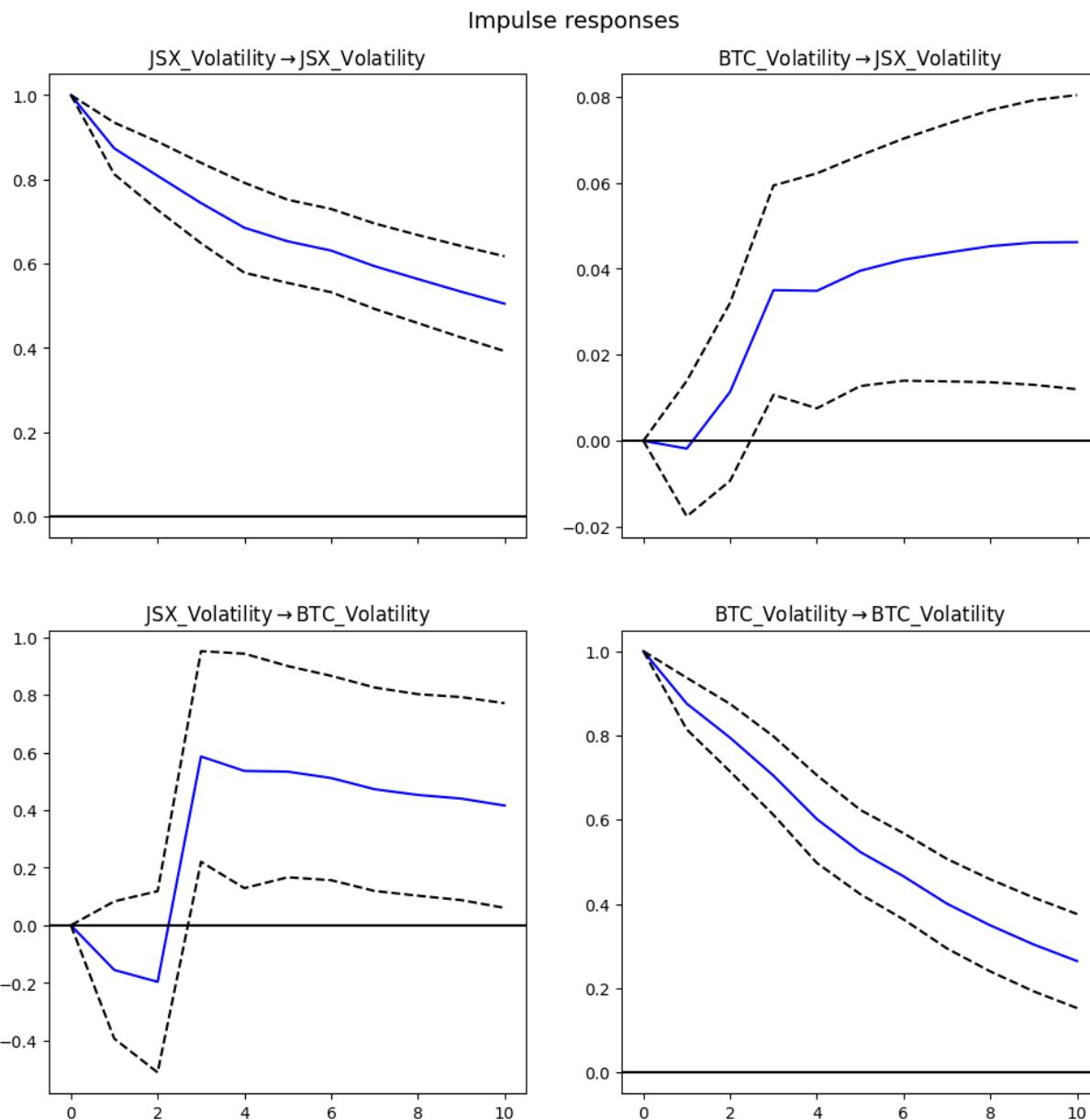


Figure 3: Impulse Responses

The Volatility Spillover Matrix quantifies the extent of volatility transmission between these markets. The matrix shows that JSX volatility is predominantly self-driven, with only a small portion being influenced by BTC volatility. BTC volatility, while also primarily influenced by its own past behavior, shows some spillover from JSX, indicating a reciprocal relationship between

these two markets. On the other hand, the USD/IDR exchange rate's volatility appears largely independent, with minimal spillover effects from either JSX or BTC, underscoring its relative insulation from the volatility observed in the other two markets.

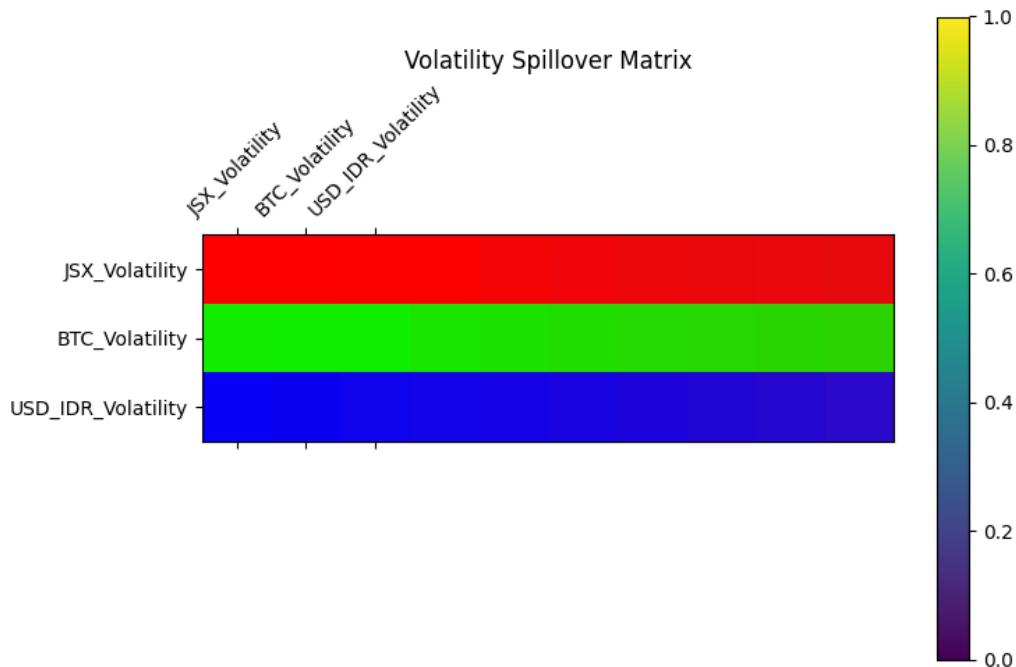


Figure 4: Volatility Spillover Matrix Between JSX, BTC, and USD/IDR

These findings underscore the nuanced interactions between traditional financial markets and the cryptocurrency market, highlighting the potential for volatility transmission and the importance of understanding these dynamics for risk management and investment strategy.

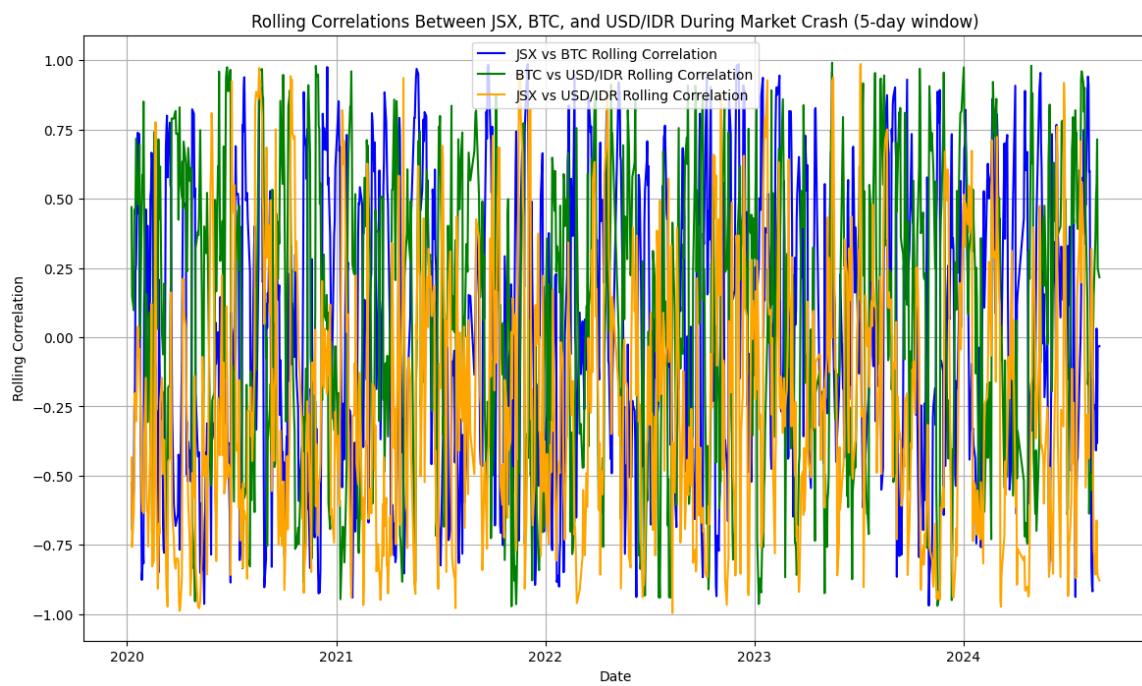


Figure 5: Rolling Correlation Between JSX, BTC, and USD/IDR During Market Crash

The graph illustrates the rolling correlations between the Jakarta Stock Exchange Composite Index (JSX), Bitcoin (BTC), and the USD/IDR exchange rate over the market crash period and extending beyond, using a 5-day rolling window.

The correlation between JSX and BTC (represented by the blue line) is highly volatile, swinging between positive and negative values throughout the observed period. This volatility suggests that the relationship between traditional stock markets and cryptocurrency is unstable; at times, they move in tandem, indicating a positive correlation, while at other moments, they diverge, showing a negative correlation. The absence of a consistent pattern underscores the distinct nature of these markets and their differing reactions to various economic events, reflecting the contrasting investor bases in each market.

Similarly, the correlation between BTC and the USD/IDR exchange rate (depicted by the green line) shows significant fluctuation, although it appears somewhat less volatile compared to the JSX-BTC correlation. Periods of positive correlation may indicate that both BTC and USD/IDR are responding similarly to global financial conditions, possibly driven by investor sentiment towards safe-haven assets or concerns over currency devaluation. However, the overall lower volatility in this correlation suggests a relatively weaker relationship compared to that of JSX and BTC.

The correlation between JSX and USD/IDR (illustrated by the orange line) is also volatile, fluctuating between positive and negative values. This pattern reflects the dynamic interaction between Indonesia's stock market and its currency, where changes in the stock market might influence the currency exchange rate, or vice versa, depending on prevailing economic conditions.

The inconsistency in this correlation points to multiple influencing factors, such as foreign investment flows and monetary policy, which could be affecting this relationship.

In conclusion, the rolling correlation analysis reveals that the relationships between these markets are complex and unstable, especially during periods of economic stress like a market crash. The highly volatile correlations, particularly between JSX and BTC, highlight the challenges in predicting their interactions, making it difficult to rely on these assets for diversification or hedging during volatile periods. These findings suggest that relying on historical correlations may not always provide a reliable guide for future behavior, especially in times of crisis. Consequently, continuous monitoring and flexible investment strategies may be necessary to manage risks effectively across these markets.

4.3 Robustness Checks

To ensure the reliability and validity of the results obtained from the analyses, robustness checks were conducted using several approaches, including the examination of alternative lag lengths, alternative volatility measures, and sub-sample analyses. These checks were essential in confirming that the findings were not artifacts of specific model settings or time periods.

Firstly, the Vector Autoregression (VAR) model and Granger causality tests were rerun using different lag lengths. The stability of the results across varying lag lengths indicated that the key findings—particularly the influence of JSX volatility on BTC volatility—remained consistent. This consistency across different lag structures reinforced the robustness of the conclusion that JSX can impact BTC volatility, even though the reverse effect is less significant.

Additionally, alternative measures of volatility were employed to validate the use of the GARCH model. These measures included realized volatility and range-based estimators. The results obtained from these alternative volatility measures were in alignment with those derived from the GARCH model, confirming that the initial findings were not dependent on the choice of volatility measurement. This consistency suggests that the GARCH model is appropriate for capturing the volatility dynamics of JSX, BTC, and USD/IDR during the study period.

Further robustness was demonstrated through sub-sample analysis, where the data was divided into different periods, especially before and after major market events like the onset of the COVID-19 pandemic. The relationships observed between JSX, BTC, and USD/IDR held true across these different periods, indicating that the results are not confined to specific market conditions. This analysis suggests that the findings are broadly applicable and not overly sensitive to particular time frames.

Overall, the robustness checks confirm that the results of the volatility, spillover, and correlation analyses are reliable and can be trusted for making informed investment decisions and risk management strategies. The consistency of the results across different models, measures, and time periods underscores the validity of the findings and their applicability in various market scenarios.

4.4 Interpretation of Results and Implications for Investment Strategy

The analyses conducted in this study reveal important insights into the behavior of JSX, BTC, and USD/IDR, particularly during periods of market stress such as the COVID-19 pandemic. These insights have significant implications for investment strategies, especially in the context of portfolio diversification and risk management.

The volatility analysis highlighted the distinct risk profiles of the assets under study. BTC, with its much higher volatility compared to JSX and USD/IDR, confirms its status as a high-risk, high-reward asset. Investors holding BTC must be prepared for substantial price swings, which, while potentially offering high returns, also pose significant risks during market downturns. Conversely, the relatively lower volatility of JSX and the even more stable USD/IDR suggest these assets may serve as more stable components within a diversified portfolio.

The volatility spillover analysis provided further insights into the interconnectedness of these markets. The finding that JSX volatility can significantly influence BTC volatility, while the reverse is less pronounced, indicates that shocks in traditional equity markets can spill over into the cryptocurrency market. This relationship suggests that during periods of high volatility in the stock market, investors should anticipate increased volatility in BTC, which may require adjustments to their portfolios to manage risk effectively. The relatively lower spillover from BTC to JSX implies that the stock market is somewhat insulated from the more extreme volatility experienced in the cryptocurrency market, making it a potentially stabilizing force in a mixed-asset portfolio.

The correlation analysis, particularly the rolling correlations, underscores the dynamic relationship between these assets. The finding that the correlation between JSX and BTC increases during market crises suggests that these assets, while typically uncorrelated, may move together during times of economic stress. This behavior implies that the diversification benefits of holding both assets may diminish during market downturns, necessitating a re-evaluation of portfolio composition during such periods. The low correlation between USD/IDR and the other two assets supports its role as a potential hedge in a diversified portfolio, especially during volatile market conditions.

The robustness checks, including alternative lag lengths, volatility measures, and sub-sample analyses, confirm the reliability of these findings. The consistency of the results across different methodologies and time periods enhances confidence in the conclusions drawn from this study, suggesting that the observed relationships between JSX, BTC, and USD/IDR are not artifacts of specific model choices or time frames.

In conclusion, this study provides valuable insights for investors seeking to navigate the complex dynamics of traditional and emerging markets. The interplay between JSX and BTC, particularly in terms of volatility spillover and correlation, highlights the need for careful risk management and portfolio diversification strategies. Investors should consider the potential for increased volatility and reduced diversification benefits during market crises when structuring their portfolios. The findings also suggest that USD/IDR may serve as a stabilizing asset in a mixed-asset portfolio, providing a hedge against the more volatile equity and cryptocurrency markets. These insights can

guide investment decisions, helping investors to better manage risk and optimize returns in an increasingly interconnected global financial landscape.

CONCLUSION

5.1. Conclusion

The analysis of volatility, spillover effects, and correlations among JSX, BTC, and USD/IDR during the market crash period provides crucial insights into the behavior of these assets under stress. The key findings from this analysis underscore the importance of understanding the unique risk profiles of each asset class, their interdependencies, and how these factors influence portfolio management strategies.

Volatility Insights: The marked difference in volatility levels between BTC, JSX, and USD/IDR confirms the inherently high-risk nature of cryptocurrencies compared to traditional assets. This high volatility can offer substantial returns but also comes with significant risk, particularly during periods of market instability. On the other hand, the relatively lower volatility of JSX and the stability of USD/IDR reinforce their roles as more predictable and potentially safer investments during turbulent times.

Intermarket Influence and Spillover Effects: The volatility spillover analysis reveals a significant influence of JSX on BTC, indicating that shocks in the traditional stock market can have repercussions in the cryptocurrency market. This finding highlights the interconnectedness of these markets, suggesting that investors need to monitor equity markets closely as they could indirectly affect cryptocurrency holdings. However, the lower spillover from BTC to JSX suggests that while the stock market influences cryptocurrencies, the reverse is less impactful, thereby insulating traditional equity markets to some extent from cryptocurrency volatility.

Correlation Dynamics: The dynamic nature of correlations, particularly during crises, suggests that the typical diversification benefits of holding both traditional and digital assets may not hold during periods of extreme market stress. The increase in correlation between JSX and BTC during the market crash underscores the potential for converging risks in what are typically considered diverse asset classes. This finding indicates that during times of crisis, the perceived diversification benefits could diminish, requiring investors to reassess their portfolio strategies and consider other assets, such as USD/IDR, which shows lower correlation with both JSX and BTC.

Robustness of Findings: The robustness checks affirm the consistency and reliability of these findings across different time periods and model specifications. This consistency provides confidence that the observed relationships are not merely statistical anomalies but reflect genuine market dynamics that investors need to account for in their strategies.

Implications for Investors: For investors, these insights underscore the need for a nuanced approach to portfolio management. The high volatility and interconnectedness of JSX and BTC, especially during crises, suggest that investors should be prepared for increased risk during such

periods. The findings also emphasize the importance of including assets like USD/IDR in a portfolio to provide a stabilizing effect and mitigate risks associated with more volatile assets.

In summary, this study highlights the complex interplay between traditional and digital assets in a portfolio, particularly during periods of market stress. Investors are advised to consider these dynamics carefully, especially the potential for volatility spillover and the changing nature of correlations, to optimize their portfolio strategies and manage risk effectively.

5.2. Future Research

Based on the insights gained from this study on the intermarket influence between traditional stock markets (specifically JSX) and cryptocurrencies (specifically BTC), several avenues for future research are recommended:

1. **Expanding the Scope to Other Emerging Markets:** While this study focused on Indonesia, extending the analysis to other emerging markets could provide a broader understanding of how cryptocurrencies interact with traditional financial markets in different economic contexts. Comparative studies across multiple emerging economies would be valuable to identify patterns or unique dynamics that may exist in these regions.
2. **Deepening the Understanding of Investor Behavior:** The study touched on the potential influence of market volatility on investor behavior, but this relationship warrants further exploration. Future research could focus on the behavioral aspects of investors in the context of volatility spillovers, particularly how different investor segments (e.g., retail vs. institutional investors) respond to volatility in cryptocurrency versus traditional stock markets.
3. **Exploring the Impact of Regulatory Changes:** The evolving regulatory landscape surrounding cryptocurrencies could have significant implications for their relationship with traditional financial markets. Future studies could examine how different regulatory frameworks influence the volatility and correlation dynamics between cryptocurrencies and traditional assets.
4. **Investigating the Role of Other Cryptocurrencies:** This research focused on Bitcoin due to its prominence, but there is potential to explore the dynamics of other cryptocurrencies, such as Ethereum or emerging altcoins, and their interactions with stock markets. This could help in understanding whether the observed phenomena are unique to Bitcoin or applicable to the broader cryptocurrency market.
5. **Longitudinal Analysis Post-Market Crises:** Given the findings related to the COVID-19 pandemic, future research could conduct longitudinal studies to examine how the relationships between traditional stock markets and cryptocurrencies evolve in the aftermath of market crises. Such studies would provide insights into the long-term implications of market stress on intermarket relationships.
6. **Developing Predictive Models:** Based on the observed volatility spillovers and correlations, there is an opportunity to develop predictive models that can forecast the

impact of shocks in traditional markets on cryptocurrency markets and vice versa. These models could be useful for investors and policymakers in managing risk and making informed decisions.

7. **Evaluating the Role of Financial Literacy and Education:** Considering the high-risk nature of cryptocurrencies highlighted in the study, future research could assess the role of financial literacy and investor education in mitigating risks associated with cryptocurrency investments. This could involve examining how different levels of financial literacy affect investor behavior and market outcomes.

These future research directions could significantly contribute to the growing body of literature on the intersection of traditional financial markets and cryptocurrencies, offering deeper insights and practical implications for market participants and regulators.

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