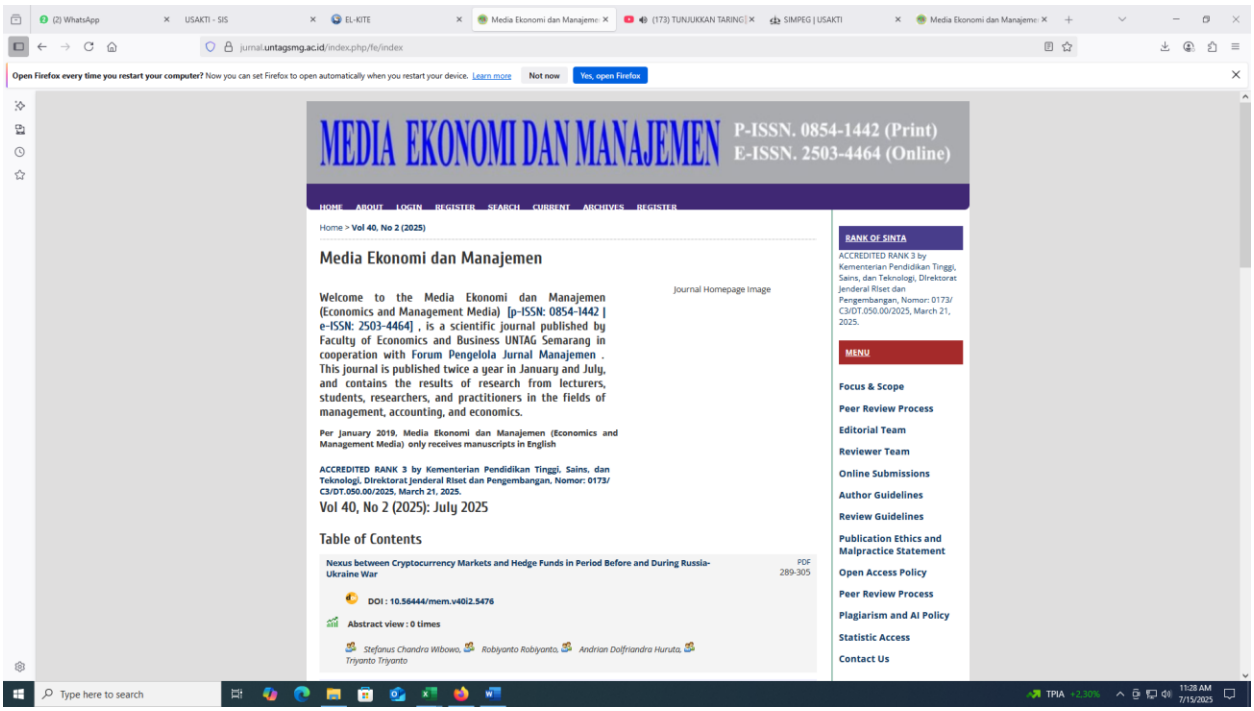

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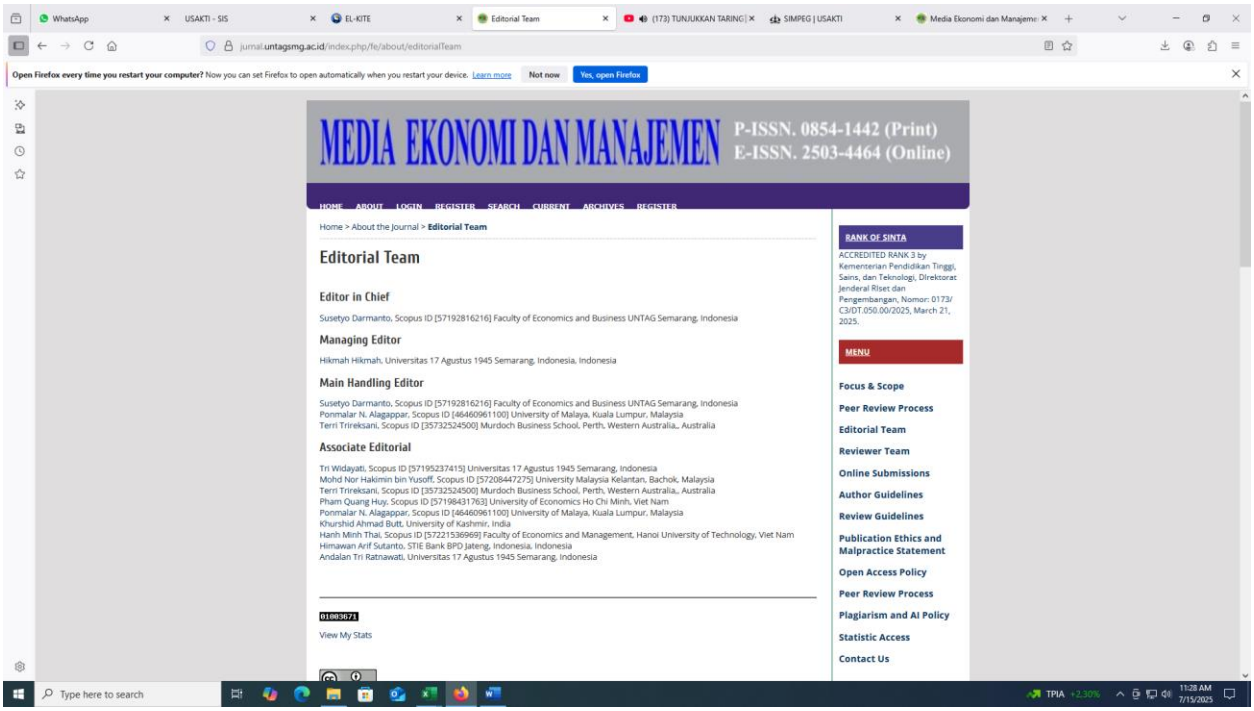

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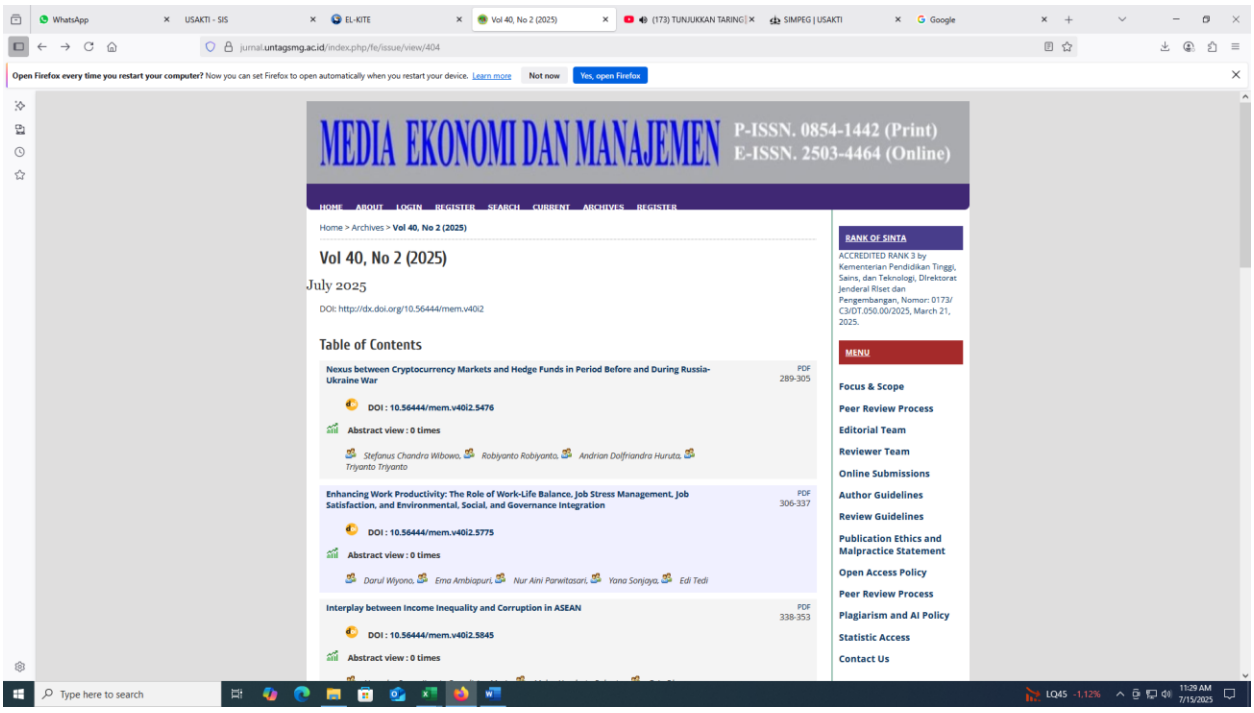
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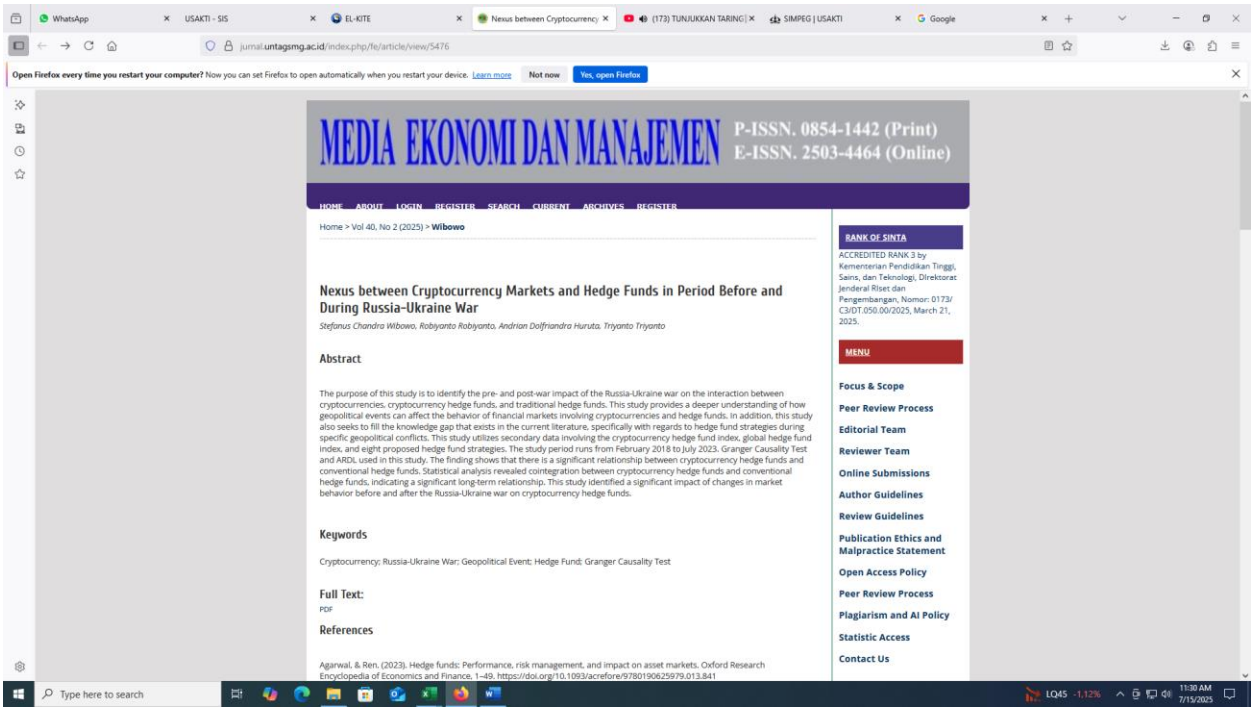
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Abstract
The purpose of this study is to identify the pre- and post-war impact of the Russia-Ukraine war on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds. This study provides a deeper understanding of how geopolitical events can affect the behavior of financial markets involving cryptocurrencies and hedge funds. In addition, this study also seeks to fill the knowledge gap that exists in the current literature, specifically with regards to hedge fund strategies during specific geopolitical conflicts. This study utilizes secondary data involving the cryptocurrency hedge fund index, global hedge fund index, and eight proposed hedge fund strategies. The study period runs from February 2018 to July 2023. Granger Causality Test and ARDL used in this study. The finding shows that there is a significant relationship between cryptocurrency hedge funds and conventional hedge funds. Statistical analysis revealed cointegration between cryptocurrency hedge funds and conventional hedge funds, indicating a significant long-term relationship. This study identified a significant impact of changes in market behavior before and after the Russia-Ukraine war on cryptocurrency hedge funds.
Keywords
Cryptocurrency; Russia-Ukraine War; Geopolitical Event; Hedge Fund; Granger Causality Test
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NEXUS BETWEEN CRYPTOCURRENCY MARKETS AND HEDGE FUNDS IN PERIOD BEFORE AND DURING RUSSIA-UKRAINE WAR

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Abstract

The purpose of this study is to identify the pre- and post-war impact of the Russia-Ukraine war on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds. This study provides a deeper understanding of how geopolitical events can affect the behavior of financial markets involving cryptocurrencies and hedge funds. In addition, this study also seeks to fill the knowledge gap that exists in the current literature, specifically with regards to hedge fund strategies during specific geopolitical conflicts. This study utilizes secondary data involving the cryptocurrency hedge fund index, global hedge fund index, and eight proposed hedge fund strategies. The study period runs from February 2018 to July 2023. Granger Causality Test and ARDL used in this study. The finding shows that there is a significant relationship between cryptocurrency hedge funds and conventional hedge funds. Statistical analysis revealed cointegration between cryptocurrency hedge funds and conventional hedge funds, indicating a significant long-term relationship. This study identified a significant impact of changes in market behavior before and after the Russia-Ukraine war on cryptocurrency hedge funds.

Keyword: Cryptocurrency; Russia-Ukraine War; Geopolitical Event; Hedge Fund; Granger Causality Test

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INTRODUCTION

On February 24, 2022, the Russia-Ukraine War began, which had a major impact on global financial markets (Martin, 2022). Global stock markets, commodities and stock indices were hit with significant declines following the Russian invasion. Although stock and commodity markets responded quickly, the impact of this invasion was less than the 2008 global financial crisis and the Covid-19 pandemic (Izzeldin et al., 2023). During the period of conflict between Russia and Ukraine, there was a notable increase in Bitcoin trading measured in Russian Rubles and Ukrainian Hryvnia (Godbole, 2022). Notably, the volume of Bitcoin trading measured in both currencies reached its highest peak throughout the conflict period.

The Ukrainian government has also actively stepped up efforts to collect cryptocurrency-based donations, with the aim of cushioning the economic impact of the war situation (Sparkes, 2022). Many organizations in Russia have started adopting cryptocurrencies in an attempt to avoid the negative impact of economic sanctions. This was evidenced by the actions of the Russian central bank and the Russian Ministry of Finance in September 2022, when they announced plans to allow the use of cryptocurrencies in cross-border payments (Namcios, 2022). As such, this reflects a significant change in direction in the outlook towards the use of cryptocurrencies by financial institutions in various countries (Gail, 2022).

The period of the Russia-Ukraine war could have caused investors to be more interested in cryptocurrencies, which in turn affected the prices as well as fluctuations in the value of cryptocurrencies (Goodell et al., 2023). In addition, war situations can also create geopolitical uncertainty that can affect market sentiment and disrupt crypto trading (Boubaker et al., 2022). According to research by Shahzad et al. (2019), it shows that cryptocurrencies, especially Bitcoin, can be considered a relatively safe form of investment when the economic and political situation is unstable. Investors may decide to use cryptocurrencies as a way to diversify their portfolios and hedge their wealth against possible declines in the value of traditional currencies or instability in traditional financial markets (Izzeldin et al., 2023).

Russia's military incursion into Ukraine has also had effects on the cryptocurrency and hedge fund markets. Some potential effects include market volatility and risk management exacerbated by the war, which could challenge hedge funds' ability to maintain stable returns on their investments (Ustaoglu, 2023). Moreover, investment opportunities may also arise especially in the crypto market, where geopolitical disruptions may create price fluctuations that can be exploited by hedge funds that have expertise in analyzing the impact of geopolitics on the market (Ustaoglu, 2023). Research by Goodell et al. (2023) shows that the impact of such invasions is felt diversely on hedge funds, including cryptocurrencies.

Cryptocurrencies are digital assets that rely on encrypted networks to conduct, verify, and record transactions, independently of centralized authorities such as governments or banks (Montevirgen, 2023). Bitcoin and Ethereum are the two largest cryptocurrencies by market capitalization (Coinmarketcap, 2023). Bitcoin, as the first and largest cryptocurrency, was developed in 2009 as an alternative monetary option. It functions as an alternative to the United States dollar and other fiat currencies. In contrast, Ethereum is the second largest cryptocurrency by market value. Ethereum was created as an innovative ledger technology that supports companies in sending data securely, storing information, and building new programs and applications with guaranteed security (Montevirgen, 2023). The majority of hedge fund investors, 91%, revealed that they are now more likely to invest in the

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two largest cryptocurrencies, Bitcoin and Ethereum, compared to 67% in 2022, indicating a shift towards a more conservative investment approach with a focus on large-cap coins (PWC, 2023).

The study of crypto hedge funds has become common among investors. A crypto hedge fund is a type of investment that includes cryptocurrencies in its portfolio, with investors paying fees based on investment performance (Chladek et al., 2023). The main objective is to manage risk and increase potential returns, especially in volatile crypto market conditions (Lahmiri & Bekiros, 2020). While there are many opportunities for investment managers to establish crypto hedge funds, there is still a risk of impact from global factors that need to be taken into account on the performance of these funds (Charfeddine et al., 2020). Research by Ma et al. (2020) indicates that some crypto hedge funds have managed to outperform traditional investments. Besides the potential opportunity to achieve greater investment returns, crypto hedge funds have several comparative advantages compared to traditional hedge funds. One of them is the still limited level of competition in the crypto hedge fund industry, which tends to reduce the impetus for fund managers to reduce costs, increase the use of leverage, and take additional risks (Bianchi & Babiak, 2022).

Research by Ashraf et al. (2023) focuses on the impact of the Russia-Ukraine War and the COVID-19 Pandemic on crypto assets. The research findings of Ashraf et al. (2023) showed that the interdependence between Bitcoin and other assets such as precious metals and Islamic stock markets increased during the crisis period. Research by Ghorbel & Jeribi (2021) states that the cryptocurrency market has significant dependence among cryptocurrencies themselves, but has a low level of correlation with conventional financial assets when the market situation is stable. However, during periods of economic instability such as the COVID-19 pandemic, the correlation between cryptocurrencies and traditional financial assets has increased (Ghorbel & Jeribi, 2021).

Several studies examined by Jeris et al. (2022) found a positive or negative correlation between cryptocurrency price movements and stock price movements, depending on the specific cryptocurrency and stock index analyzed. Research by Kumar et al. (2023) also showed that during the COVID-19 Pandemic and the Russia-Ukraine conflict, there was a strong dependency between commodities, cryptocurrencies, and the stock market. However, to date, no research has focused on the relationship between crypto markets and hedge fund strategies during the Russia-Ukraine conflict period. Therefore, this study focuses on the pre- and post-war impact of Russia-Ukraine on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds.

This research has the theoretical benefit of expanding the understanding of the complex interrelationships between crypto markets, cryptocurrency hedge funds and traditional hedge funds, particularly during the period of the Russia-Ukraine conflict. By exploring this relationship, the research can contribute to the development of current financial theory and enrich the academic literature in this domain. Practically, the research results are expected to provide valuable insights for market participants, including investors, hedge fund managers, and regulators, to optimize their investment strategies amid geopolitical uncertainty.

The purpose of this study is to identify the pre- and post-war impact of the Russia-Ukraine war on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds. By evaluating the market dynamics during this period of conflict, the research aims to provide a deeper understanding of how geopolitical events can affect the behavior of financial markets involving crypto-

currencies and hedge funds. In addition, the research also seeks to fill the knowledge gap that exists in the current literature, specifically with regards to hedge fund strategies during specific geopolitical conflicts. As such, this research is expected to make a significant contribution to the practical and academic understanding of the complex interactions among global financial markets, particularly in the context of cryptocurrencies and hedge funds.

LITERATURE REVIEW

Hedge fund

A hedge fund is a form of investment partnership that raises funds from private investors and uses a variety of strategies to achieve active returns for investors (SEC, 2023). Unlike mutual funds that are strictly regulated by financial authorities, hedge funds have more freedom to pursue diverse investments and strategies that may increase the risk of investment losses (Benmahi & Avci, 2023). Investment in hedge funds is usually limited to high-net-worth individuals who can afford the high costs and risks inherent in investing in hedge funds, as well as institutional investors such as pension funds. In investing in hedge funds, there are several risks including potential capital losses, lack of information disclosure regarding the hedge fund's portfolio and investment strategy (Chladek et al., 2023). In addition, there are high costs that can reduce returns, liquidity risks that cause limitations on withdrawals (Agarwal & Ren, 2023). Hedge funds have managerial risk because hedge fund managers have full authority over investment decisions, and the potential for concentrated strategies that can result in large gains or losses (Yunus, 2021).

Cryptocurrency Hedge Fund

The concept of a crypto hedge fund is similar to the principle of a conventional hedge fund, which provides an opportunity for individual investors to contribute to an investment fund managed by experts (Coinmarketcap, 2023). These funds are used to invest in a variety of blockchain projects, with an emphasis on equity investments, early-stage tokens, and other opportunities. Fund managers who have expertise in recognizing opportunities, trading in volatile markets, and identifying trends, aim to increase the net asset value of the fund (Bailey et al., 2011). Typically, these funds have minimum investment requirements and fee structures that involve management fees as well as performance fees. Leading companies in crypto investing include Grayscale Investments, Multicoin Capital, Pantera Capital, and Polychain Capital (SWFI, 2023). While some crypto funds can generate substantial returns thanks to the volatility of the crypto market, risk is also a factor, as seen in the collapse of several crypto hedge funds (Khelifa et al., 2021).

Conventional Hedge Funds Strategy

Hedge funds are financial entities that implement various strategies to achieve optimal returns and carefully manage risks (Khelifa et al., 2021). Some of the common strategies used by hedge funds include Long/Short Equity, event-driven, global macro, arbitrage, as well as multi-strategy. Long/Short Equity, for instance, focuses on going long in low-priced stocks while short-selling high-priced stocks (Wang et al., 2023). Event-driven strategies, on the other hand, pursue opportunities arising from specific events in the life of the company, which may impact the valuation of the security, as described in a study by Dergisi et al. (2022). Meanwhile, other strategies such as global macro take risks based on global macroeconomic trends such as changes in interest rates, currency values, demographic changes, and economic cycles, referring to the study conducted by Khelifa et al. (2021). Arbitrage is an investment strategy that involves buying and selling assets in various markets to capitalize on price differences, and hedge funds use this

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strategy to profit from price differences (Wang et al., 2023). Meanwhile, multi-strategy hedge funds combine various strategies of a single hedge fund in one portfolio, with each strategy having unique characteristics (Dergisi et al., 2022). Thus, hedge funds adopt various strategies that suit specific objectives and market conditions to achieve maximum investment returns.

DATA AND METHOD

Data Type and Source

This research utilizes secondary data involving the cryptocurrency hedge fund index, global hedge fund index, and eight proposed hedge fund strategies documented in the Eurekahedge Hedge Fund index database, which can be accessed through the official website https://www.eurekahedge.com.

Specifically, this study utilizes the Crypto Hedge fund index and nine conventional hedge fund indices relating to various strategies, including the Global Hedge fund index, Arbitrage index, Troubled Debt index, Event Driven index, Fixed Income index, Long/Short Equity index, Macro index, Multi Strategy index, and Relative Value index. The time span of this data covers the period from February 2018 to July 2023 (Table 1).

This research also utilizes secondary cryptocurrency data from the crypto asset data source Coinmarketcap (2023), which can be accessed through the official website https://coinmarketcap.com/. The focus of this research is on the three cryptocurrencies that have the highest trading rates and largest market capitalization, namely Bitcoin, Ethereum, and Tether. The combined market capitalization value of these three cryptocurrencies represents more than 80% of the top ten cryptocurrencies by market capitalization at the end of July 2023 (Investing.com, 2023). The study period runs from February 2018 to July 2023, with a total of 68 monthly observations for closing prices and market capitalization. The separation of the period before and after the Russia-Ukraine war is based on when President Putin announced Russia's invasion of Ukraine on February 24, 2022 (Lami, 2022).

Operational Definition of Variables

The rate of return of the variables in this study uses the calculation of the return of each variable, which is formulated as follows:

$$Return\ Crypto = \frac{(\text{Price of } Crypto_t - \text{Price of } Crypto_{t-1})}{\text{Price of } Crypto_{t-1}} \quad (1)$$

$$Return\ Hedge\ Fund = \frac{(\text{Price of } Hedge\ Fund_t - \text{Price of } Hedge\ Fund_{t-1})}{\text{Price of } Hedge\ Fund_{t-1}} \quad (2)$$

Where:

Price of $Crypto_t$: Crypto closing price on day t

Price of $Crypto_{t-1}$: Crypto closing price on day t-1

Price of $Hedge\ Fund_t$: Hedge Fund closing price on day t

Price of $Hedge\ Fund_{t-1}$: Hedge Fund closing price on day t-1

Table 1. Key Characteristics of the top 5 Cryptocurrencies as of July 14, 2023

Name of the Cryptocurrency	*Symbol*	*Market Capitalization ($)*	*Traded Volume (24 h) ($)*
Bitcoin	BTC	$504,127,157,753	$17,388,757,141
Ethereum	ETH	$191,088,783,242	$6,008,816,254
Tether	USDT	$83,092,674,467	$24,896,466,867

Source(s): Coinmarketcap, data processed.

Analysis Technique

Relationship between Cryptocurrency Hedge funds and Conventional Hedge Funds Strategies

In this study, an analysis was conducted to understand the relationship between crypto hedge funds and conventional hedge fund strategies. The analysis utilizes Granger causation tests to explore the potential impact of changes in one index on changes in the other.

The first step is to check the data to identify single root problems and maintain the stability of the variables using the Augmented Dickey Fuller (ADF) test, with the formula below:

$$\Delta v_t = \alpha_i + \beta_i \sum_{i=1}^{p} \Delta v_{t-1} + \varepsilon_t \quad (3)$$

Description:
v : vector of 2 variables
α_i : vector of intercepts
β_i : vector of regression coefficients
p : number of lags considered
ε_t : vector of error terms

Furthermore, the number of past observations that should be included in the analysis is determined based on the Akaike information criterion (AIC), with the formula:

$$\text{AIC} = 2k - 2 \ln (L) \quad (4)$$

Description:
k : number of temporary parameters
l : maximum value of the likelihood of the model

Then a cointegration test using the Johansen method was conducted to assess the long-term relationship between crypto hedge funds and conventional hedge funds, it is important to evaluate the long-term impact between indices. A bivariate model was constructed to reflect how changes in both indices may affect each other, including considering the impact of the Russia-Ukraine war. Thus, the bivariate VAR model is as follows:

$$CRTH_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i CRTH_{t-1} + \sum_{i=1}^{p} \beta_i HFI_{t-1} + RUW + u_{1t} \quad (5)$$

$$HFI_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i HFI_{t-1} + \sum_{i=1}^{p} \beta_i CRTH_{t-1} + RUW + u_{2t} \quad (6)$$

Description:
$CRTH_{t-1}$: Cryptocurrency hedge fund index value in month t
HFI_{t-1} : Conventional hedge fund index value in month t
RUW: Russian-Ukrainian dummy variable
t-1: pre-crisis period (February 2018 – January 2022)
t: crisis period (February 2022 – July 2023)
p: number of lags according to AIC

Finally, the research tests for Granger causation using the Wald Test to explore the potential influence between the two indices. If evidence of a strong relationship is found, it indicates that changes in one index may serve as an indicator of changes in the other index. If there is a long-term relationship, the research will apply the Vector Error Correction (VEC) model for further analysis, understanding the relationship in the short and long term. The VEC Model formula is as follows:

$$\Delta CRTH_t = a_0 + \sum_{i=1}^{p-1} a_i \Delta CRTH_{t-1} + \sum_{i=1}^{p-1} b_i \Delta HFI_{t-1} + w_1 ECT_{t-1} + RUW + u_{1t} \quad (7)$$

$$\Delta HFI_t = c_0 + \sum_{i=1}^{p-1} c_i \Delta HFI_{t-1} + \sum_{i=1}^{p-1} d_i \Delta CRTH_{t-1} + w_2 ECT_{t-1} + RUW + u_{2t} \quad (8)$$

Description:
Δ: first difference operator
p-1: lag length minus 1
ai, bi, ci, and d: short-run dynamic coefficients that determine the short-run relationship between the variables
w1 dan w2: speed of adjustment of parameters to long-run equilibrium
u_{1t}dan u_{2t}: residual terms

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Before and After Impact of Russia-Ukraine War on Cryptocurrency Hedge funds and Cryptocurrencies

This study aims to uncover changes in the relationship between crypto hedge funds and some major cryptocurrencies such as Bitcoin, Ethereum, and Tether before and after the Russia-Ukraine war using the Autoregressive Distributed Lag (ARDL) method. The advantages of the ARDL method, which is suitable for limited data and remains relevant in the face of variations in cryptocurrency changes, are the reasons for its selection. The study began with an ARDL boundary test to identify the long-run relationship between the two aspects before and after the Russia-Ukraine war, with the ARDL model helping to detect the possibility of a continuous relationship. The ARDL model formula is as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^{*}RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^{*}RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^{*}RUW)_{t-1} + \alpha_1 RUW + \alpha_2 CRTH_{t-1} + \alpha_3 BTC_{t-1} + \alpha_4 ETH_{t-1} + \alpha_5 TET_{t-1} + \alpha_6 (BTC^{*}RUW)_{t-1} + \alpha_7 (ETH^{*}RUW)_{t-1} + \alpha_8 (TET^{*}RUW)_{t-1} + \epsilon_t \quad (9)$$

Description:
$\beta_2 - \beta_2$: short-term dynamic relationship
$\alpha_2 - \alpha_8$: Long-run dynamic relationship
$p1 - p7$: maximum lag order determined by AIC or SBIC

If there is a relationship, the above ARDL model will be used to explore the effect of changes in crypto hedge funds on cryptocurrencies by involving various variables and coefficients. However, if there is no significant long-term relationship, the study will continue to estimate the ARDL model to understand the role of the relationship in the long and short term before and after the Russia-Ukraine war.

The ARDL model if there is no long-run relationship is as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^{*}RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^{*}RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^{*}RUW)_{t-1} + \epsilon_t \quad (10)$$

Description:
$\beta_2 - \beta_2$: short-term dynamic relationship
$p1 - p7$: maximum lag order determined by AIC or SBIC
However, if cointegration occurs, the ARDL-ECM model is determined as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^{*}RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^{*}RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^{*}RUW)_{t-1} + \gamma ECT_{t-1} + \epsilon_t \quad (11)$$

Description:
γ : adjustment speed parameter
ECT : error correction term
$\beta_1 - \beta_8$: short-run dynamic coefficient of the model in adjustment to the long-run equilibrium

Thus, this study uses the ARDL method to analyze the changes in the relationship between crypto hedge funds and major cryptocurrencies before and after the Russia-Ukraine war and how the dynamics of the relationship evolved over the period.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Table 2 shows the results of descriptive statistical testing on the Crypto Hedge fund index, nine Conventional Hedge Fund indexes, and the 3 largest capitalized Cryptocurrencies. The descriptive statistical analysis contained in Table 2 includes descriptive statistics involving the calcu-

lation of the mean, maximum, minimum, standard deviation, and number of observations of various Hedge Funds and the three largest capitalized crypto-currencies.

The highest average return was observed for Ethereum (ETH) among Cryptocurrencies, with a value of 0.047928, followed by Bitcoin (BTC) at 0.037825, while Tether had the lowest average return of 0.000217. In terms of standard deviation, Ethereum (ETH) showed the highest standard deviation, at 0.294555, indicating a relatively higher risk compared to various Hedge Funds and other types of cryptocurrencies. Whereas, Tether has a very low standard deviation of 0.005002, indicating minimal variation and more stable performance as a stablecoin. Among the Conventional Hedge Fund strategies, Long-Short Equities has the highest standard deviation of 0.025976, indicating a relatively high level of risk. In contrast, the Arbitrage strategy shows the lowest standard deviation among the Conventional Hedge Fund strategies at 0.009372, indicating a more stable pattern of returns.

Relationship between Cryptocurrency Hedge funds and Conventional Hedge Funds Strategies

Table 3 shows the results of the ADF Unit Roots test for various variables. This test aims to determine whether a series of data has a unit root or not, which indicates its stationarity. In Table 3, there are t-statistics and p-value for each variable. The t-statistics reflect the ADF test value for each variable, while the p-value indicates the statistical significance level of the test. The p-value obtained is 0.0000 which indicates that all these data are stationary.

Table 4 displays the Lag Selection results in the VAR (Vector Autoregression) model for various comparisons between Cryptocurrency Hedge Funds and various Conventional Hedge Funds. The evaluation metrics include FPE (Final Prediction Error), AIC (Akaike Information Criterion), HQIC (Hannan-Quinn Information Criterion), and SBIC (Schwarz Bayesian Information Criterion). In Table 4, all the values of these metrics are zero, indicating that in the investigated VAR models, lag selection does not have a significant impact on improving model quality. This suggests that, in this context, the simplest VAR model (without lags) is sufficient to explain the relationship between Crypto-currency Hedge Funds and other Conventional Hedge Funds to be observed.

Table 5 reveals the results of the Johansen Cointegration Test for the various VAR models comparing the Crypto-currency Hedge Fund and the various Conventional Hedge Funds. This test is used to determine whether or not there is a long-run relationship between two time series. From the results of Table 5, see that the Trace Statistics for each VAR model exceeds the critical value, indicating the presence of cointegration between Crypto-currency Hedge Fund and the other asset classes observed. This indicates that there is a significant long-term relationship between Cryptocurrency Hedge Fund and various Conventional Hedge Funds, which could have important implications in investment analysis and risk management. This result contradicts the study by Khelifa et al. (2021), where only Multi Strategy Hedge Fund has a long-term relationship with Cryptocurrency Hedge Fund.

The Johansen Cointegration Test results listed in Table 5 show that all data are cointegrated. This indicates the existence of a long-run equilibrium relationship among all the observed variables. In this context, Granger Causality testing is irrelevant because it only applies to two variables that are not cointegrated (Khelifa et al., 2021). Therefore, the next step in the analysis requires an approach that uses a VECM (Vector Error Correction Model) model to understand the short-run and long-run relationships between the variables.

Table 6 presents the results of the analysis using the VECM (Vector Error

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Correction Model) to evaluate the correlation between Cryptocurrency Hedge Funds and various types of Conventional Hedge Funds. The results of the analysis indicate that there is a significant negative relationship between the Cryptocurrency Hedge Fund and the various types of Conventional Hedge Funds, which is reinforced by the negative coefficient values recorded for each comparison. Specifically, the negative coefficient indicates that any increase in the value of a particular type of Conventional Hedge Fund will result in a proportional decrease in the value of the Cryptocurrency Hedge Fund. This signifies that investments in different types of Conventional Hedge Funds tend to have a negative impact on the performance of Cryptocurrency Hedge Funds. This result is consistent with the research of Khelifa et al. (2021), where Multi Strategy Hedge Fund has a negative relationship with Cryptocurrency Hedge Fund.

Table 2. Descriptive Statistical Analysis of Various Hedge Funds and 3 Cryptocurrencies

	Mean	***Maximum***	***Minimum***	***Std. Dev.***	***No. of obs.***
Cryptocurrency Hedge Fund	0.020891	0.438007	-0.336712	0.168756	66
Conventional Hedge Fund Indices					
Global	0.004254	0.052124	-0.066042	0.018320	66
Arbitrage	0.004076	0.029717	-0.022530	0.009372	66
Distressed Debt	0.005747	0.059456	-0.124951	0.023215	66
Event Driven	0.003976	0.064847	-0.117935	0.024476	66
Fixed Income	0.002722	0.027346	-0.086987	0.014995	66
Long-Short Equities	0.004384	0.071575	-0.094924	0.025976	66
Macro	0.003328	0.038211	-0.031501	0.011890	66
Multi Strategy	0.003683	0.043388	-0.065278	0.016097	66
Relative Value	0.003371	0.041312	-0.045673	0.014671	66
Cryptocurrency					
BTC	0.037825	0.608461	-0.373247	0.215440	66
ETH	0.047928	0.784333	-0.537404	0.294555	66
Tether	0.000217	0.020088	-0.021456	0.005002	66

Source(s): Investing.com, data processed.

Table 3. ADF Unit Roots Test

Variables	***t-Statistics***	***p-Value***
LNCrypto	-6.769089	0.0000
LNGlobal	-7.366698	0.0000
LNArbitrage	-7.194635	0.0000
LNDistressed Debt	-6.958182	0.0000
LNEvent Driven	-7.505653	0.0000
LNFixed Income	-7.611128	0.0000
LNLong-Short Equities	-7.654804	0.0000
LNMacro	-7.381270	0.0000
LNMulti-Strategy	-7.620900	0.0000
LNRelative Value	-7.245355	0.0000
LNBTC	-6.675026	0.0000
LNETH	-8.051820	0.0000
LNTether	-8.530915	0.0000

Source(s): Investing.com, data processed.

Table 4. *Lag Selection*

VAR Model	FPE	AIC	HQIC	SBIC
Cryptocurrency Hedge Fund vs. Global Hedge fund	0	0	0	0
Cryptocurrency Hedge Fund vs. Arbitrage	0	0	0	0
Cryptocurrency Hedge Fund vs. Distressed Debt	0	0	0	0
Cryptocurrency Hedge Fund vs. Event Driven	0	0	0	0
Cryptocurrency Hedge Fund vs. Fixed Income	0	0	0	0
Cryptocurrency Hedge Fund vs. Long Short Equities	0	0	0	0
Cryptocurrency Hedge Fund vs. Macro	0	0	0	0
Cryptocurrency Hedge Fund vs. Multi-Strategy	0	0	0	0
Cryptocurrency Hedge Fund vs. Relative Value	0	0	0	0

Source(s): Investing.com, data processed.

Table 5. Johansen Cointegration Test Results

VAR Model	*Max. Rank*	*Trace Statistics*	*5% Critical value*
Cryptocurrency Hedge Fund vs. Global Hedge fund	1	9.244218	3.841466
Cryptocurrency Hedge Fund vs. Arbitrage	1	10.04834	3.841466
Cryptocurrency Hedge Fund vs. Distressed Debt	1	9.696468	3.841466
Cryptocurrency Hedge Fund vs. Event Driven	1	9.465386	3.841466
Cryptocurrency Hedge Fund vs. Fixed Income	1	9.626554	3.841466
Cryptocurrency Hedge Fund vs. Long Short Equities	1	9.326603	3.841466
Cryptocurrency Hedge Fund vs. Macro	1	9.17557	3.841466
Cryptocurrency Hedge Fund vs. Multi-Strategy	1	9.385811	3.841466
Cryptocurrency Hedge Fund vs. Relative Value	1	9.1629	3.841466

Source(s): Investing.com, data processed.

Table 6. VECM Estimation Results

VECM Model	*Coefficient*	*Std. Error*	*t-statistics*	*Relationship Between the Two Indices*
Cryptocurrency Hedge Fund vs. Global Hedge fund	-11.2939	1.1044	-10.2264*	*negative*
Cryptocurrency Hedge Fund vs. Arbitrage	-20.0957	2.0991	-9.5736*	*negative*
Cryptocurrency Hedge Fund vs. Distressed Debt	-8.1043	1.0740	-7.5458*	*negative*
Cryptocurrency Hedge Fund vs. Event Driven	-9.0051	0.9484	-9.4955*	*negative*
Cryptocurrency Hedge Fund vs. Fixed Income	-29.5994	3.5154	-8.4199*	*negative*
Cryptocurrency Hedge Fund vs. Long Short Equities	-9.3489	0.9767	-9.5723*	*negative*
Cryptocurrency Hedge Fund vs. Macro	-19.2024	2.0149	-9.5301*	*negative*
Cryptocurrency Hedge Fund vs. Multi-Strategy	-15.5904	1.6154	-9.6512*	*negative*
Cryptocurrency Hedge Fund vs. Relative Value	-14.0697	1.7032	-8.2608*	*negative*

** significant at 1% significance level*
Source(s): Investing.com, data processed.

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Overall, the results of this analysis reinforce the view that the relationship between Cryptocurrency Hedge Funds and other types of Conventional Hedge Funds tends to be negative. A decrease in the value of Cryptocurrency Hedge Funds corresponds to an increase in the value of Conventional Hedge Funds, and vice versa. This suggests that investments in cryptocurrency hedge funds may provide additional protection against value fluctuations in conventional hedge fund portfolios. With significant adjustments in the short term, the two types of funds continue to interact dynamically, reflecting the complexity of inter-market relationships. This analysis provides valuable information, where crypto hedge funds can be used as diversifying assets against value fluctuations in the portfolios of conventional hedge funds. The results of this study are consistent with the results of Charfeddine et al. (2020) and Khelifa et al. (2021), which states Cryptocurrency can be a diversification tool. The results of this study contradict the research of Colon et al. (2021), which states cryptocurrencies cannot be used as a safe haven against geopolitical risks in most cases. However, research by Ma et al. (2020) showed that cryptocurrencies have played an active role in portfolio diversification and provided better results in specific risk returns compared to portfolios without cryptocurrencies.

Before and After Impact of Russia-Ukraine War on Cryptocurrency Hedge funds and Cryptocurrencies

This research aims to provide a better understanding of how unstable geopolitical conditions can affect digital financial assets, by analyzing changes in market behavior before and after the war. In addition, the research also aims to explore how market participants, including hedge funds and cryptocurrency investors, adjust their investment strategies in the face of global political uncertainty.

Before War

The regression analysis in Table 7 reveals an interesting picture of the impact of Before War on Cryptocurrency Hedge Funds, Bitcoin, Ethereum, and Tether. From the results, it can be seen that the Before War variable has a coefficient that shows a negative trend towards the value of Cryptocurrency Hedge Funds. This indicates that there is a potential influence of market uncertainty or anxiety before the conflict.

In Table 7, the Ethereum variable shows a significant effect on cryptocurrency hedge funds. The Ethereum variable has a coefficient of 0.443532 and a t-statistic of 1.893624. This indicates that changes in the pre-war price of Ethereum had a significant impact on the performance of cryptocurrency hedge funds. The variable-interaction between Ethereum and Before War conditions also showed a significant impact on cryptocurrency hedge funds. However, Bitcoin and Tether variables did not show a significant impact on cryptocurrency hedge funds. The results of this analysis provide an insight into how geopolitical events such as war can affect the performance of the cryptocurrency market and its associated hedge funds.

After War

Analysis of the ARDL estimation results in Table 8 reveals the variation in the impact of the aftermath of the Russia-Ukraine War on Cryptocurrency Hedge Funds and Cryptocurrencies. It is seen that the effect of this war varies depending on the type of cryptocurrency considered, indicating a degree of heterogeneity in the market response to geopolitical events such as the conflict. These findings highlight the importance of the individual characteristics of each cryptocurrency in influencing the market response, as well as suggesting that there is a complex interaction between geopolitical events, cryptocurrency type, and market behavior.

The results of Table 8 show that there are variations in the impact after the

Russia-Ukraine War on Cryptocurrency Hedge Funds and Crypto Currencies. The After War variable has a significant effect on Cryptocurrency Hedge Funds. The After War variable has a coefficient of 0.029619 with a t-statistic of 1.194473. Meanwhile, the Bitcoin and Ethereum variables show a significant effect on cryptocurrency hedge funds. The Bitcoin variable has a coefficient of 0.212565 (2.310715), while Ethereum has a coefficient of 0.153488 (2.070908). This indicates that changes in Bitcoin and Ethereum prices after the war had a significant impact on the performance of cryptocurrency hedge funds. However, the interaction variable between Bitcoin and Ethereum with After War conditions showed no significant impact on cryptocurrency hedge funds. The Tether variable also shows an insignificant positive impact, with a coefficient of 0.436890 (0.162585). The results of this analysis provide an insight into how geopolitical events such as war can affect the performance of the cryptocurrency market and its associated hedge funds once the conflict period begins. The results of this study are consistent with Theiri et al. (2022) and Tabak et al. (2023) who state that wars significantly affect the cryptocurrency market especially Bitcoin, but this effect is temporary. These results contradict Karasińki & Zadrożny (2023) who stated that the conflict did not significantly affect the cryptocurrency market. However, according to research by Appiah-Otoo (2023), the war between Russia and Ukraine had a significant impact on the cryptocurrency market, especially bitcoin, with a decrease in trading volume after one week post-invasion.

CONCLUSION AND RECOMMENDATIONS

This research shows that there is a significant relationship between cryptocurrency hedge funds and conventional hedge funds, where a decrease in the value of cryptocurrency hedge funds is associated with an increase in the value of conventional hedge funds, and vice versa. Ethereum shows the highest average return among cryptocurrencies, albeit with high risk, while Tether stands out as a stablecoin with greater stability. Statistical analysis revealed cointegration between cryptocurrency hedge funds and conventional hedge funds, indicating a significant long-term relationship. In addition, this study identified a significant impact of changes in market behavior before and after the Russia-Ukraine war on cryptocurrency hedge funds, with the war having a significant positive impact on the value of cryptocurrency hedge funds, suggesting a complex market response to geopolitical events. Asset diversification between cryptocurrency hedge funds and conventional hedge funds is identified as a strategy that can reduce risk and capitalize on return opportunities amid geopolitical uncertainty. Although this study has some limitations, such as the use of data from a single source and limited time coverage, the results provide important insights for investors in developing portfolio diversification strategies that are adaptive to geopolitical dynamics. Further research is recommended to expand the analysis of the impact of geopolitical events on cryptocurrency markets, including price volatility and investor behavior, to provide a deeper understanding of the interaction between geopolitical conditions and digital financial markets.

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Table 7. ARDL Estimation Results Before the War

Dependent variable: Δ ***Cryptocurrency Hedge Funds***	
Explanatory variables	***Coefficient***
Δ *Cryptocurrency Hedge Funds (− 1)*	0.609165*** (6.319881)
Before War	-0.029619** (-1.194473)
Bitcoin	-0.080902 (-0.323675)
Δ *Bitcoin (− 1)*	-0.088422 (-1.488997)
Ethereum	0.443532* (1.893624)
Δ *Ethereum (− 1)*	-0.055709** (-1.679129)
*Bitcoin*Before War*	0.293466 (1.120127)
*Ethereum*Before War*	-0.290044 (-1.190841)
Tether	-9.058755 (-0.121264)
Δ *Tether (− 1)*	-0.071464 (-0.075615)
*Tether*Before War*	9.495645 (0.127162)
C	0.006061 (0.292361)
N	64
R-squared	0.869747

*** significant at 1% significance level
** significant at 5% significance level
* significant at 10% significance level
The number in parentheses is t count

Source(s): Investing.com, data processed.

Table 8. ARDL Estimation Results After the War

Dependent variable: Δ ***Cryptocurrency Hedge Funds***	
Explanatory variables	***Coefficient***
Δ *Cryptocurrency Hedge Funds (− 1)*	0.609165*** (6.319881)
After War	0.029619** (1.194473)
Bitcoin	0.212565** (2.310715)
Δ *Bitcoin (− 1)*	-0.088422 (-1.488997)
Ethereum	0.153488** (2.070908)
Δ *Ethereum (− 1)*	-0.055709* (-1.679129)
*Bitcoin*After War*	-0.293466 (-1.120127)
*Ethereum*After War*	0.290044 (1.190841)
Tether	0.436890 (0.162585)
Δ *Tether (− 1)*	-0.071464 (-0.075615)
*Tether*After War*	-9.495645 (-0.127162)
C	-0.023557* (-1.737661)
N	64
R-squared	0,869747

***significant at 1% significance level
**significant at 5% significance level
* significant at 10% significance level
The number in parentheses is t count

Source(s): Investing.com, data processed.

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NEXUS BETWEEN CRYPTOCURRENCY MARKETS AND HEDGE FUNDS IN PERIOD BEFORE AND DURING RUSSIA-UKRAINE WAR

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Abstract

The purpose of this study is to identify the pre- and post-war impact of the Russia-Ukraine war on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds. This study provides a deeper understanding of how geopolitical events can affect the behavior of financial markets involving cryptocurrencies and hedge funds. In addition, this study also seeks to fill the knowledge gap that exists in the current literature, specifically with regards to hedge fund strategies during specific geopolitical conflicts. This study utilizes secondary data involving the cryptocurrency hedge fund index, global hedge fund index, and eight proposed hedge fund strategies. The study period runs from February 2018 to July 2023. Granger Causality Test and ARDL used in this study. The finding shows that there is a significant relationship between cryptocurrency hedge funds and conventional hedge funds. Statistical analysis revealed cointegration between cryptocurrency hedge funds and conventional hedge funds, indicating a significant long-term relationship. This study identified a significant impact of changes in market behavior before and after the Russia-Ukraine war on cryptocurrency hedge funds.

Keyword: Cryptocurrency; Russia-Ukraine War; Geopolitical Event; Hedge Fund; Granger Causality Test

JEL Classification: G11, G15, G19

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INTRODUCTION

On February 24, 2022, the Russia-Ukraine War began, which had a major impact on global financial markets (Martin, 2022). Global stock markets, commodities and stock indices were hit with significant declines following the Russian invasion. Although stock and commodity markets responded quickly, the impact of this invasion was less than the 2008 global financial crisis and the Covid-19 pandemic (Izzeldin et al., 2023). During the period of conflict between Russia and Ukraine, there was a notable increase in Bitcoin trading measured in Russian Rubles and Ukrainian Hryvnia (Godbole, 2022). Notably, the volume of Bitcoin trading measured in both currencies reached its highest peak throughout the conflict period.

The Ukrainian government has also actively stepped up efforts to collect cryptocurrency-based donations, with the aim of cushioning the economic impact of the war situation (Sparkes, 2022). Many organizations in Russia have started adopting cryptocurrencies in an attempt to avoid the negative impact of economic sanctions. This was evidenced by the actions of the Russian central bank and the Russian Ministry of Finance in September 2022, when they announced plans to allow the use of cryptocurrencies in cross-border payments (Namcios, 2022). As such, this reflects a significant change in direction in the outlook towards the use of cryptocurrencies by financial institutions in various countries (Gail, 2022).

The period of the Russia-Ukraine war could have caused investors to be more interested in cryptocurrencies, which in turn affected the prices as well as fluctuations in the value of cryptocurrencies (Goodell et al., 2023). In addition, war situations can also create geopolitical uncertainty that can affect market sentiment and disrupt crypto trading (Boubaker et al., 2022). According to research by Shahzad et al. (2019), it shows that cryptocurrencies, especially Bitcoin, can be considered a relatively safe form of investment when the economic and political situation is unstable. Investors may decide to use cryptocurrencies as a way to diversify their portfolios and hedge their wealth against possible declines in the value of traditional currencies or instability in traditional financial markets (Izzeldin et al., 2023).

Russia's military incursion into Ukraine has also had effects on the cryptocurrency and hedge fund markets. Some potential effects include market volatility and risk management exacerbated by the war, which could challenge hedge funds' ability to maintain stable returns on their investments (Ustaoglu, 2023). Moreover, investment opportunities may also arise especially in the crypto market, where geopolitical disruptions may create price fluctuations that can be exploited by hedge funds that have expertise in analyzing the impact of geopolitics on the market (Ustaoglu, 2023). Research by Goodell et al. (2023) shows that the impact of such invasions is felt diversely on hedge funds, including cryptocurrencies.

Cryptocurrencies are digital assets that rely on encrypted networks to conduct, verify, and record transactions, independently of centralized authorities such as governments or banks (Montevirgen, 2023). Bitcoin and Ethereum are the two largest cryptocurrencies by market capitalization (Coinmarketcap, 2023). Bitcoin, as the first and largest cryptocurrency, was developed in 2009 as an alternative monetary option. It functions as an alternative to the United States dollar and other fiat currencies. In contrast, Ethereum is the second largest cryptocurrency by market value. Ethereum was created as an innovative ledger technology that supports companies in sending data securely, storing information, and building new programs and applications with guaranteed security (Montevirgen, 2023). The majority of hedge fund investors, 91%, revealed that they are now more likely to invest in the

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two largest cryptocurrencies, Bitcoin and Ethereum, compared to 67% in 2022, indicating a shift towards a more conservative investment approach with a focus on large-cap coins (PWC, 2023).

The study of crypto hedge funds has become common among investors. A crypto hedge fund is a type of investment that includes cryptocurrencies in its portfolio, with investors paying fees based on investment performance (Chladek et al., 2023). The main objective is to manage risk and increase potential returns, especially in volatile crypto market conditions (Lahmiri & Bekiros, 2020). While there are many opportunities for investment managers to establish crypto hedge funds, there is still a risk of impact from global factors that need to be taken into account on the performance of these funds (Charfeddine et al., 2020). Research by Ma et al. (2020) indicates that some crypto hedge funds have managed to outperform traditional investments. Besides the potential opportunity to achieve greater investment returns, crypto hedge funds have several comparative advantages compared to traditional hedge funds. One of them is the still limited level of competition in the crypto hedge fund industry, which tends to reduce the impetus for fund managers to reduce costs, increase the use of leverage, and take additional risks (Bianchi & Babiak, 2021).

Research by Ashraf et al. (2023) focuses on the impact of the Russia-Ukraine War and the COVID-19 Pandemic on crypto assets. The research findings of Ashraf et al. (2023) showed that the interdependence between Bitcoin and other assets such as precious metals and Islamic stock markets increased during the crisis period. Research by Ghorbel & Jeribi (2021) states that the cryptocurrency market has significant dependence among cryptocurrencies themselves, but has a low level of correlation with conventional financial assets when the market situation is stable. However, during periods of economic instability such as the COVID-19 pandemic, the correlation between cryptocurrencies and traditional financial assets has increased (Ghorbel & Jeribi, 2021).

Several studies examined by Jeris et al. (2022) found a positive or negative correlation between cryptocurrency price movements and stock price movements, depending on the specific cryptocurrency and stock index analyzed. Research by Kumar et al. (2023) also showed that during the COVID-19 Pandemic and the Russia-Ukraine conflict, there was a strong dependency between commodities, cryptocurrencies, and the stock market. However, to date, no research has focused on the relationship between crypto markets and hedge fund strategies during the Russia-Ukraine conflict period. Therefore, this study focuses on the pre- and post-war impact of Russia-Ukraine on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds.

This research has the theoretical benefit of expanding the understanding of the complex interrelationships between crypto markets, cryptocurrency hedge funds and traditional hedge funds, particularly during the period of the Russia-Ukraine conflict. By exploring this relationship, the research can contribute to the development of current financial theory and enrich the academic literature in this domain. Practically, the research results are expected to provide valuable insights for market participants, including investors, hedge fund managers, and regulators, to optimize their investment strategies amid geopolitical uncertainty.

The purpose of this study is to identify the pre- and post-war impact of the Russia-Ukraine war on the interaction between cryptocurrencies, cryptocurrency hedge funds, and traditional hedge funds. By evaluating the market dynamics during this period of conflict, the research aims to provide a deeper understanding of how geopolitical events can affect the behavior of financial markets involving crypto-

currencies and hedge funds. In addition, the research also seeks to fill the knowledge gap that exists in the current literature, specifically with regards to hedge fund strategies during specific geopolitical conflicts. As such, this research is expected to make a significant contribution to the practical and academic understanding of the complex interactions among global financial markets, particularly in the context of cryptocurrencies and hedge funds.

LITERATURE REVIEW

Hedge fund

A hedge fund is a form of investment partnership that raises funds from private investors and uses a variety of strategies to achieve active returns for investors (SEC, 2023). Unlike mutual funds that are strictly regulated by financial authorities, hedge funds have more freedom to pursue diverse investments and strategies that may increase the risk of investment losses (Benmahi & Avci, 2023). Investment in hedge funds is usually limited to high-net-worth individuals who can afford the high costs and risks inherent in investing in hedge funds, as well as institutional investors such as pension funds. In investing in hedge funds, there are several risks including potential capital losses, lack of information disclosure regarding the hedge fund's portfolio and investment strategy (Chladek et al., 2023). In addition, there are high costs that can reduce returns, liquidity risks that cause limitations on withdrawals (Agarwal & Ren, 2023). Hedge funds have managerial risk because hedge fund managers have full authority over investment decisions, and the potential for concentrated strategies that can result in large gains or losses (Yunus, 2021).

Cryptocurrency Hedge Fund

The concept of a crypto hedge fund is similar to the principle of a conventional hedge fund, which provides an opportunity for individual investors to contribute to an investment fund managed by experts (Coinmarketcap, 2023). These funds are used to invest in a variety of blockchain projects, with an emphasis on equity investments, early-stage tokens, and other opportunities. Fund managers who have expertise in recognizing opportunities, trading in volatile markets, and identifying trends, aim to increase the net asset value of the fund (Bailey et al., 2011). Typically, these funds have minimum investment requirements and fee structures that involve management fees as well as performance fees. Leading companies in crypto investing include Grayscale Investments, Multicoin Capital, Pantera Capital, and Polychain Capital (SWFI, 2023). While some crypto funds can generate substantial returns thanks to the volatility of the crypto market, risk is also a factor, as seen in the collapse of several crypto hedge funds (Khelifa et al., 2021).

Conventional Hedge Funds Strategy

Hedge funds are financial entities that implement various strategies to achieve optimal returns and carefully manage risks (Khelifa et al., 2021). Some of the common strategies used by hedge funds include Long/Short Equity, event-driven, global macro, arbitrage, as well as multi-strategy. Long/Short Equity, for instance, focuses on going long in low-priced stocks while short-selling high-priced stocks (Wang et al., 2023). Event-driven strategies, on the other hand, pursue opportunities arising from specific events in the life of the company, which may impact the valuation of the security, as described in a study by Dergisi et al. (2022). Meanwhile, other strategies such as global macro take risks based on global macroeconomic trends such as changes in interest rates, currency values, demographic changes, and economic cycles, referring to the study conducted by Khelifa et al. (2021). Arbitrage is an investment strategy that involves buying and selling assets in various markets to capitalize on price differences, and hedge funds use this

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strategy to profit from price differences (Wang et al., 2023). Meanwhile, multi-strategy hedge funds combine various strategies of a single hedge fund in one portfolio, with each strategy having unique characteristics (Dergisi et al., 2022). Thus, hedge funds adopt various strategies that suit specific objectives and market conditions to achieve maximum investment returns.

DATA AND METHOD

Data Type and Source

This research utilizes secondary data involving the cryptocurrency hedge fund index, global hedge fund index, and eight proposed hedge fund strategies documented in the Eurekahedge Hedge Fund index database, which can be accessed through the official website https://www.eurekahedge.com.

Specifically, this study utilizes the Crypto Hedge fund index and nine conventional hedge fund indices relating to various strategies, including the Global Hedge fund index, Arbitrage index, Troubled Debt index, Event Driven index, Fixed Income index, Long/Short Equity index, Macro index, Multi Strategy index, and Relative Value index. The time span of this data covers the period from February 2018 to July 2023 (Table 1).

This research also utilizes secondary cryptocurrency data from the crypto asset data source Coinmarketcap (2023), which can be accessed through the official website https://coinmarketcap.com/. The focus of this research is on the three cryptocurrencies that have the highest trading rates and largest market capitalization, namely Bitcoin, Ethereum, and Tether. The combined market capitalization value of these three cryptocurrencies represents more than 80% of the top ten cryptocurrencies by market capitalization at the end of July 2023 (Investing.com, 2023). The study period runs from February 2018 to July 2023, with a total of 68 monthly observations for closing prices and market capitalization. The separation of the period before and after the Russia-Ukraine war is based on when President Putin announced Russia's invasion of Ukraine on February 24, 2022 (Lami, 2022).

Operational Definition of Variables

The rate of return of the variables in this study uses the calculation of the return of each variable, which is formulated as follows:

$$Return\ Crypto = \frac{(\text{Price of } Crypto_t - \text{Price of } Crypto_{t-1})}{\text{Price of } Crypto_{t-1}} \quad (1)$$

$$Return\ Hedge\ Fund = \frac{(\text{Price of } Hedge\ Fund_t - \text{Price of } Hedge\ Fund_{t-1})}{\text{Price of } Hedge\ Fund_{t-1}} \quad (2)$$

Where:

Price of $Crypto_t$: Crypto closing price on day t

Price of $Crypto_{t-1}$: Crypto closing price on day t-1

Price of $Hedge\ Fund_t$: Hedge Fund closing price on day t

Price of $Hedge\ Fund_{t-1}$: Hedge Fund closing price on day t-1

Table 1. Key Characteristics of the top 5 Cryptocurrencies as of July 14, 2023

Name of the Cryptocurrency	*Symbol*	*Market Capitalization ($)*	*Traded Volume (24 h) ($)*
Bitcoin	BTC	$504,127,157,753	$17,388,757,141
Ethereum	ETH	$191,088,783,242	$6,008,816,254
Tether	USDT	$83,092,674,467	$24,896,466,867

Source(s): Coinmarketcap, data processed.

Analysis Technique

Relationship between Cryptocurrency Hedge funds and Conventional Hedge Funds Strategies

In this study, an analysis was conducted to understand the relationship between crypto hedge funds and conventional hedge fund strategies. The analysis utilizes Granger causation tests to explore the potential impact of changes in one index on changes in the other.

The first step is to check the data to identify single root problems and maintain the stability of the variables using the Augmented Dickey Fuller (ADF) test, with the formula below:

$$\Delta v_t = \alpha_i + \beta_i \sum_{i=1}^{p} \Delta v_{t-1} + \varepsilon_t \quad (3)$$

Description:
v : vector of 2 variables
α_i : vector of intercepts
β_i : vector of regression coefficients
p : number of lags considered
ε_t : vector of error terms

Furthermore, the number of past observations that should be included in the analysis is determined based on the Akaike information criterion (AIC), with the formula:

$$AIC = 2k - 2 \ln(L) \quad (4)$$

Description:
k : number of temporary parameters
l : maximum value of the likelihood of the model

Then a cointegration test using the Johansen method was conducted to assess the long-term relationship between crypto hedge funds and conventional hedge funds, it is important to evaluate the long-term impact between indices. A bivariate model was constructed to reflect how changes in both indices may affect each other, including considering the impact of the Russia-Ukraine war. Thus, the bivariate VAR model is as follows:

$$CRTH_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i CRTH_{t-1} + \sum_{i=1}^{p} \beta_i HFI_{t-1} + RUW + u_{1t} \quad (5)$$

$$HFI_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i HFI_{t-1} + \sum_{i=1}^{p} \beta_i CRTH_{t-1} + RUW + u_{2t} \quad (6)$$

Description:
$CRTH_{t-1}$: Cryptocurrency hedge fund index value in month t
HFI_{t-1} : Conventional hedge fund index value in month t
RUW: Russian-Ukrainian dummy variable
t-1: pre-crisis period (February 2018 – January 2022)
t: crisis period (February 2022 – July 2023)
p: number of lags according to AIC

Finally, the research tests for Granger causation using the Wald Test to explore the potential influence between the two indices. If evidence of a strong relationship is found, it indicates that changes in one index may serve as an indicator of changes in the other index. If there is a long-term relationship, the research will apply the Vector Error Correction (VEC) model for further analysis, understanding the relationship in the short and long term. The VEC Model formula is as follows:

$$\Delta CRTH_t = a_0 + \sum_{i=1}^{p-1} a_i \Delta CRTH_{t-1} + \sum_{i=1}^{p-1} b_i \Delta HFI_{t-1} + w_1 ECT_{t-1} + RUW + u_{1t} \quad (7)$$

$$\Delta HFI_t = c_0 + \sum_{i=1}^{p-1} c_i \Delta HFI_{t-1} + \sum_{i=1}^{p-1} d_i \Delta CRTH_{t-1} + w_2 ECT_{t-1} + RUW + u_{2t} \quad (8)$$

Description:
Δ: first difference operator
p-1: lag length minus 1
ai, bi, ci, and d: short-run dynamic coefficients that determine the short-run relationship between the variables
w1 dan w2: speed of adjustment of parameters to long-run equilibrium
u_{1t}dan u_{2t}: residual terms

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Before and After Impact of Russia-Ukraine War on Cryptocurrency Hedge funds and Cryptocurrencies

This study aims to uncover changes in the relationship between crypto hedge funds and some major cryptocurrencies such as Bitcoin, Ethereum, and Tether before and after the Russia-Ukraine war using the Autoregressive Distributed Lag (ARDL) method. The advantages of the ARDL method, which is suitable for limited data and remains relevant in the face of variations in cryptocurrency changes, are the reasons for its selection. The study began with an ARDL boundary test to identify the long-run relationship between the two aspects before and after the Russia-Ukraine war, with the ARDL model helping to detect the possibility of a continuous relationship. The ARDL model formula is as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^* RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^* RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^* RUW)_{t-1} + \alpha_1 RUW + \alpha_2 CRTH_{t-1} + \alpha_3 BTC_{t-1} + \alpha_4 ETH_{t-1} + \alpha_5 TET_{t-1} + \alpha_6 (BTC^* RUW)_{t-1} + \alpha_7 (ETH^* RUW)_{t-1} + \alpha_8 (TET^* RUW)_{t-1} + \epsilon_t \quad (9)$$

Description:
$\beta_2 - \beta_2$: short-term dynamic relationship
$\alpha_2 - \alpha_8$: Long-run dynamic relationship
$p1 - p7$: maximum lag order determined by AIC or SBIC

If there is a relationship, the above ARDL model will be used to explore the effect of changes in crypto hedge funds on cryptocurrencies by involving various variables and coefficients. However, if there is no significant long-term relationship, the study will continue to estimate the ARDL model to understand the role of the relationship in the long and short term before and after the Russia-Ukraine war.

The ARDL model if there is no long-run relationship is as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^* RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^* RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^* RUW)_{t-1} + \epsilon_t \quad (10)$$

Description:
$\beta_2 - \beta_2$: short-term dynamic relationship
$p1 - p7$: maximum lag order determined by AIC or SBIC
However, if cointegration occurs, the ARDL-ECM model is determined as follows:

$$\Delta CRTH_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta CRTH_{t-1} + \sum_{i=1}^{p1} \beta_2 \Delta BTC_{t-1} + \sum_{i=1}^{p2} \beta_3 \Delta ETH_{t-1} + \sum_{i=1}^{p3} \beta_4 \Delta TET_{t-1} + \sum_{i=1}^{p4} \beta_5 \Delta RUW_{t-1} + \sum_{i=1}^{p5} \beta_6 \Delta (BTC^* RUW)_{t-1} + \sum_{i=1}^{p6} \beta_7 \Delta (ETH^* RUW)_{t-1} + \sum_{i=1}^{p7} \beta_8 \Delta (TET^* RUW)_{t-1} + \gamma ECT_{t-1} + \epsilon_t \quad (11)$$

Description:
γ : adjustment speed parameter
ECT : error correction term
$\beta_1 - \beta_8$: short-run dynamic coefficient of the model in adjustment to the long-run equilibrium

Thus, this study uses the ARDL method to analyze the changes in the relationship between crypto hedge funds and major cryptocurrencies before and after the Russia-Ukraine war and how the dynamics of the relationship evolved over the period.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Table 2 shows the results of descriptive statistical testing on the Crypto Hedge fund index, nine Conventional Hedge Fund indexes, and the 3 largest capitalized Cryptocurrencies. The descriptive statistical analysis contained in Table 2 includes descriptive statistics involving the calcu-

lation of the mean, maximum, minimum, standard deviation, and number of observations of various Hedge Funds and the three largest capitalized crypto-currencies.

The highest average return was observed for Ethereum (ETH) among Cryptocurrencies, with a value of 0.047928, followed by Bitcoin (BTC) at 0.037825, while Tether had the lowest average return of 0.000217. In terms of standard deviation, Ethereum (ETH) showed the highest standard deviation, at 0.294555, indicating a relatively higher risk compared to various Hedge Funds and other types of cryptocurrencies. Whereas, Tether has a very low standard deviation of 0.005002, indicating minimal variation and more stable performance as stablecoin. Among the Conventional Hedge Fund strategies, Long-Short Equities has the highest standard deviation of 0.025976, indicating a relatively high level of risk. In contrast, the Arbitrage strategy shows the lowest standard deviation among the Conventional Hedge Fund strategies at 0.009372, indicating a more stable pattern of returns.

Relationship between Cryptocurrency Hedge funds and Conventional Hedge Funds Strategies

Table 3 shows the results of the ADF Unit Roots test for various variables. This test aims to determine whether a series of data has a unit root or not, which indicates its stationarity. In Table 3, there are t-statistics and p-value for each variable. The t-statistics reflect the ADF test value for each variable, while the p-value indicates the statistical significance level of the test. The p-value obtained is 0.0000 which indicates that all these data are stationary.

Table 4 displays the Lag Selection results in the VAR (Vector Autoregression) model for various comparisons between Cryptocurrency Hedge Funds and various Conventional Hedge Funds. The evaluation metrics include FPE (Final Prediction Error), AIC (Akaike Information Criterion), HQIC (Hannan-Quinn Information Criterion), and SBIC (Schwarz Bayesian Information Criterion). In Table 4, all the values of these metrics are zero, indicating that in the investigated VAR models, lag selection does not have a significant impact on improving model quality. This suggests that, in this context, the simplest VAR model (without lags) is sufficient to explain the relationship between Cryptocurrency Hedge Funds and other Conventional Hedge Funds to be observed.

Table 5 reveals the results of the Johansen Cointegration Test for the various VAR models comparing the Cryptocurrency Hedge Fund and the various Conventional Hedge Funds. This test is used to determine whether or not there is a long-run relationship between two time series. From the results of Table 5, see that the Trace Statistics for each VAR model exceeds the critical value, indicating the presence of cointegration between Cryptocurrency Hedge Fund and the other asset classes observed. This indicates that there is a significant long-term relationship between Cryptocurrency Hedge Fund and various Conventional Hedge Funds, which could have important implications in investment analysis and risk management. This result contradicts the study by Khelifa et al. (2021), where only Multi Strategy Hedge Fund has a long-term relationship with Cryptocurrency Hedge Fund.

The Johansen Cointegration Test results listed in Table 5 show that all data are cointegrated. This indicates the existence of a long-run equilibrium relationship among all the observed variables. In this context, Granger Causality testing is irrelevant because it only applies to two variables that are not cointegrated (Khelifa et al., 2021). Therefore, the next step in the analysis requires an approach that uses a VECM (Vector Error Correction Model) model to understand the short-run and long-run relationships between the variables.

Table 6 presents the results of the analysis using the VECM (Vector Error

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Correction Model) to evaluate the correlation between Cryptocurrency Hedge Funds and various types of Conventional Hedge Funds. The results of the analysis indicate that there is a significant negative relationship between the Cryptocurrency Hedge Fund and the various types of Conventional Hedge Funds, which is reinforced by the negative coefficient values recorded for each comparison. Specifically, the negative coefficient indicates that any increase in the value of a particular type of Conventional Hedge Fund will result in a proportional decrease in the value of the Cryptocurrency Hedge Fund. This signifies that investments in different types of Conventional Hedge Funds tend to have a negative impact on the performance of Cryptocurrency Hedge Funds. This result is consistent with the research of Khelifa et al. (2021), where Multi Strategy Hedge Fund has a negative relationship with Cryptocurrency Hedge Fund.

Table 2. Descriptive Statistical Analysis of Various Hedge Funds and 3 Cryptocurrencies

	Mean	***Maximum***	***Minimum***	***Std. Dev.***	***No. of obs.***
Cryptocurrency Hedge Fund	0.020891	0.438007	-0.336712	0.168756	66
Conventional Hedge Fund Indices					
Global	0.004254	0.052124	-0.066042	0.018320	66
Arbitrage	0.004076	0.029717	-0.022530	0.009372	66
Distressed Debt	0.005747	0.059456	-0.124951	0.023215	66
Event Driven	0.003976	0.064847	-0.117935	0.024476	66
Fixed Income	0.002722	0.027346	-0.086987	0.014995	66
Long-Short Equities	0.004384	0.071575	-0.094924	0.025976	66
Macro	0.003328	0.038211	-0.031501	0.011890	66
Multi Strategy	0.003683	0.043388	-0.065278	0.016097	66
Relative Value	0.003371	0.041312	-0.045673	0.014671	66
Cryptocurrency					
BTC	0.037825	0.608461	-0.373247	0.215440	66
ETH	0.047928	0.784333	-0.537404	0.294555	66
Tether	0.000217	0.020088	-0.021456	0.005002	66

Source(s): Investing.com, data processed.

Table 3. ADF Unit Roots Test

Variables	***t-Statistics***	***p-Value***
LNCrypto	-6.769089	0.0000
LNGlobal	-7.366698	0.0000
LNArbitrage	-7.194635	0.0000
LNDistressed Debt	-6.958182	0.0000
LNEvent Driven	-7.505653	0.0000
LNFixed Income	-7.611128	0.0000
LNLong-Short Equities	-7.654804	0.0000
LNMacro	-7.381270	0.0000
LNMulti-Strategy	-7.620900	0.0000
LNRelative Value	-7.245355	0.0000
LNBTC	-6.675026	0.0000
LNETH	-8.051820	0.0000
LNTether	-8.530915	0.0000

Source(s): Investing.com, data processed.

Table 4. *Lag Selection*

VAR Model	FPE	AIC	HQIC	SBIC
Cryptocurrency Hedge Fund vs. Global Hedge fund	0	0	0	0
Cryptocurrency Hedge Fund vs. Arbitrage	0	0	0	0
Cryptocurrency Hedge Fund vs. Distressed Debt	0	0	0	0
Cryptocurrency Hedge Fund vs. Event Driven	0	0	0	0
Cryptocurrency Hedge Fund vs. Fixed Income	0	0	0	0
Cryptocurrency Hedge Fund vs. Long Short Equities	0	0	0	0
Cryptocurrency Hedge Fund vs. Macro	0	0	0	0
Cryptocurrency Hedge Fund vs. Multi-Strategy	0	0	0	0
Cryptocurrency Hedge Fund vs. Relative Value	0	0	0	0

Source(s): Investing.com, data processed.

Table 5. Johansen Cointegration Test Results

VAR Model	*Max. Rank*	*Trace Statistics*	*5% Critical value*
Cryptocurrency Hedge Fund vs. Global Hedge fund	1	9.244218	3.841466
Cryptocurrency Hedge Fund vs. Arbitrage	1	10.04834	3.841466
Cryptocurrency Hedge Fund vs. Distressed Debt	1	9.696468	3.841466
Cryptocurrency Hedge Fund vs. Event Driven	1	9.465386	3.841466
Cryptocurrency Hedge Fund vs. Fixed Income	1	9.626554	3.841466
Cryptocurrency Hedge Fund vs. Long Short Equities	1	9.326603	3.841466
Cryptocurrency Hedge Fund vs. Macro	1	9.17557	3.841466
Cryptocurrency Hedge Fund vs. Multi-Strategy	1	9.385811	3.841466
Cryptocurrency Hedge Fund vs. Relative Value	1	9.1629	3.841466

Source(s): Investing.com, data processed.

Table 6. VECM Estimation Results

VECM Model	*Coefficient*	*Std. Error*	*t-statistics*	*Relationship Between the Two Indices*
Cryptocurrency Hedge Fund vs. Global Hedge fund	-11.2939	1.1044	-10.2264*	*negative*
Cryptocurrency Hedge Fund vs. Arbitrage	-20.0957	2.0991	-9.5736*	*negative*
Cryptocurrency Hedge Fund vs. Distressed Debt	-8.1043	1.0740	-7.5458*	*negative*
Cryptocurrency Hedge Fund vs. Event Driven	-9.0051	0.9484	-9.4955*	*negative*
Cryptocurrency Hedge Fund vs. Fixed Income	-29.5994	3.5154	-8.4199*	*negative*
Cryptocurrency Hedge Fund vs. Long Short Equities	-9.3489	0.9767	-9.5723*	*negative*
Cryptocurrency Hedge Fund vs. Macro	-19.2024	2.0149	-9.5301*	*negative*
Cryptocurrency Hedge Fund vs. Multi-Strategy	-15.5904	1.6154	-9.6512*	*negative*
Cryptocurrency Hedge Fund vs. Relative Value	-14.0697	1.7032	-8.2608*	*negative*

** significant at 1% significance level*
Source(s): Investing.com, data processed.

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Overall, the results of this analysis reinforce the view that the relationship between Cryptocurrency Hedge Funds and other types of Conventional Hedge Funds tends to be negative. A decrease in the value of Cryptocurrency Hedge Funds corresponds to an increase in the value of Conventional Hedge Funds, and vice versa. This suggests that investments in cryptocurrency hedge funds may provide additional protection against value fluctuations in conventional hedge fund portfolios. With significant adjustments in the short term, the two types of funds continue to interact dynamically, reflecting the complexity of inter-market relationships. This analysis provides valuable information, where crypto hedge funds can be used as diversifying assets against value fluctuations in the portfolios of conventional hedge funds. The results of this study are consistent with the results of Charfeddine et al. (2020) and Khelifa et al. (2021), which states Cryptocurrency can be a diversification tool. The results of this study contradict the research of Colon et al. (2021), which states cryptocurrencies cannot be used as a safe haven against geopolitical risks in most cases. However, research by Ma et al. (2020) showed that cryptocurrencies have played an active role in portfolio diversification and provided better results in specific risk returns compared to portfolios without cryptocurrencies.

Before and After Impact of Russia-Ukraine War on Cryptocurrency Hedge funds and Cryptocurrencies

This research aims to provide a better understanding of how unstable geopolitical conditions can affect digital financial assets, by analyzing changes in market behavior before and after the war. In addition, the research also aims to explore how market participants, including hedge funds and cryptocurrency investors, adjust their investment strategies in the face of global political uncertainty.

Before War

The regression analysis in Table 7 reveals an interesting picture of the impact of Before War on Cryptocurrency Hedge Funds, Bitcoin, Ethereum, and Tether. From the results, it can be seen that the Before War variable has a coefficient that shows a negative trend towards the value of Cryptocurrency Hedge Funds. This indicates that there is a potential influence of market uncertainty or anxiety before the conflict.

In Table 7, the Ethereum variable shows a significant effect on cryptocurrency hedge funds. The Ethereum variable has a coefficient of 0.443532 and a t-statistic of 1.893624. This indicates that changes in the pre-war price of Ethereum had a significant impact on the performance of cryptocurrency hedge funds. The variable-interaction between Ethereum and Before War conditions also showed a significant impact on cryptocurrency hedge funds. However, Bitcoin and Tether variables did not show a significant impact on cryptocurrency hedge funds. The results of this analysis provide an insight into how geopolitical events such as war can affect the performance of the cryptocurrency market and its associated hedge funds.

After War

Analysis of the ARDL estimation results in Table 8 reveals the variation in the impact of the aftermath of the Russia-Ukraine War on Cryptocurrency Hedge Funds and Cryptocurrencies. It is seen that the effect of this war varies depending on the type of cryptocurrency considered, indicating a degree of heterogeneity in the market response to geopolitical events such as the conflict. These findings highlight the importance of the individual characteristics of each cryptocurrency in influencing the market response, as well as suggesting that there is a complex interaction between geopolitical events, cryptocurrency type, and market behavior.

The results of Table 8 show that there are variations in the impact after the

Russia-Ukraine War on Cryptocurrency Hedge Funds and Crypto Currencies. The After War variable has a significant effect on Cryptocurrency Hedge Funds. The After War variable has a coefficient of 0.029619 with a t-statistic of 1.194473. Meanwhile, the Bitcoin and Ethereum variables show a significant effect on cryptocurrency hedge funds. The Bitcoin variable has a coefficient of 0.212565 (2.310715), while Ethereum has a coefficient of 0.153488 (2.070908). This indicates that changes in Bitcoin and Ethereum prices after the war had a significant impact on the performance of cryptocurrency hedge funds. However, the interaction variable between Bitcoin and Ethereum with After War conditions showed no significant impact on cryptocurrency hedge funds. The Tether variable also shows an insignificant positive impact, with a coefficient of 0.436890 (0.162585). The results of this analysis provide an insight into how geopolitical events such as war can affect the performance of the cryptocurrency market and its associated hedge funds once the conflict period begins. The results of this study are consistent with Theiri et al. (2022) and Tabak et al. (2023) who state that wars significantly affect the cryptocurrency market especially Bitcoin, but this effect is temporary. These results contradict Karasiński & Zadrożny (2023) who stated that the conflict did not significantly affect the cryptocurrency market. However, according to research by Appiah-Otoo (2023), the war between Russia and Ukraine had a significant impact on the cryptocurrency market, especially bitcoin, with a decrease in trading volume after one week post-invasion.

CONCLUSION AND RECOMMENDATIONS

This research shows that there is a significant relationship between cryptocurrency hedge funds and conventional hedge funds, where a decrease in the value of cryptocurrency hedge funds is associated with an increase in the value of conventional hedge funds, and vice versa. Ethereum shows the highest average return among cryptocurrencies, albeit with high risk, while Tether stands out as a stablecoin with greater stability. Statistical analysis revealed cointegration between cryptocurrency hedge funds and conventional hedge funds, indicating a significant long-term relationship. In addition, this study identified a significant impact of changes in market behavior before and after the Russia-Ukraine war on cryptocurrency hedge funds, with the war having a significant positive impact on the value of cryptocurrency hedge funds, suggesting a complex market response to geopolitical events. Asset diversification between cryptocurrency hedge funds and conventional hedge funds is identified as a strategy that can reduce risk and capitalize on return opportunities amid geopolitical uncertainty. Although this study has some limitations, such as the use of data from a single source and limited time coverage, the results provide important insights for investors in developing portfolio diversification strategies that are adaptive to geopolitical dynamics. Further research is recommended to expand the analysis of the impact of geopolitical events on cryptocurrency markets, including price volatility and investor behavior, to provide a deeper understanding of the interaction between geopolitical conditions and digital financial markets.

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Table 7. ARDL Estimation Results Before the War

Dependent variable: Δ ***Cryptocurrency Hedge Funds***	
Explanatory variables	***Coefficient***
Δ *Cryptocurrency Hedge Funds (− 1)*	0.609165*** (6.319881)
Before War	-0.029619** (-1.194473)
Bitcoin	-0.080902 (-0.323675)
Δ *Bitcoin (− 1)*	-0.088422 (-1.488997)
Ethereum	0.443532* (1.893624)
Δ *Ethereum (− 1)*	-0.055709** (-1.679129)
*Bitcoin*Before War*	0.293466 (1.120127)
*Ethereum*Before War*	-0.290044 (-1.190841)
Tether	-9.058755 (-0.121264)
Δ *Tether (− 1)*	-0.071464 (-0.075615)
*Tether*Before War*	9.495645 (0.127162)
C	0.006061 (0.292361)
N	64
R-squared	0.869747

*** significant at 1% significance level
** significant at 5% significance level
* significant at 10% significance level
The number in parentheses is t count

Source(s): Investing.com, data processed.

Table 8. ARDL Estimation Results After the War

Dependent variable:* Δ *Cryptocurrency Hedge Funds	
Explanatory variables	***Coefficient***
Δ *Cryptocurrency Hedge Funds (− 1)*	0.609165*** (6.319881)
After War	0.029619** (1.194473)
Bitcoin	0.212565** (2.310715)
Δ *Bitcoin (− 1)*	-0.088422 (-1.488997)
Ethereum	0.153488** (2.070908)
Δ *Ethereum (− 1)*	-0.055709* (-1.679129)
*Bitcoin*After War*	-0.293466 (-1.120127)
*Ethereum*After War*	0.290044 (1.190841)
Tether	0.436890 (0.162585)
Δ *Tether (− 1)*	-0.071464 (-0.075615)
*Tether*After War*	-9.495645 (-0.127162)
C	-0.023557* (-1.737661)
N	64
R-squared	0,869747

***significant at 1% significance level
**significant at 5% significance level
* significant at 10% significance level
The number in parentheses is t count

Source(s): Investing.com, data processed.

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