

Impact of Russia – Ukraine War on Bitcoin Volatility: Using GARCH Model Approach

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Abstract

The study focusses on volatility of Bitcoin in Russia – Ukraine war. We apply GARCH (1.1) model for mean and variance equation to examine the volatility of Bitcoin. The data were collected 3 months' prior war and 3 months during the war time and distribute the data in 3 panels (Entire period, before war period, and during war period). Gold, Oil, S&P 500, Exchange rates were also examined in the study in order to find out the volatility of other financial sector in the war time, correspondent to that of Bitcoin. The finding reveals that Bitcoin prices are highly volatile and unstable in the war time and does not hold its property of safe haven in the Russia – Ukraine war. Our finding provides new insight to the investor who want to invest in Bitcoin market and also provide guidelines of potential investor during the war times. Since our study carried out on short run, further studies could be carried out in the long run context.

Keywords: Bitcoin, Volatility, GARCH, Russia – Ukraine War, Safe haven

1. Introduction

Whenever there is a war it brings immense effects, which is not limited to the destruction of infrastructure but also to the economy. In today's globalization era, the war between the two countries does not limit to them only. Recent war between Russia and Ukraine, started from 24 Feb 2022 with Russian aggression, shows its impact on global economy. War is a geopolitical event which tend to stimulate panic among the general public as well as investors, the investor's confidence drops down during the war time. Stock exchange is one of the good indicators for economy stability in the country, the study incorporates the daily prices of S&P 500. Russia is one of the large oil suppliers to many countries, the study also analyzes its price volatility along with gold and exchange rates. Bitcoin is regarded as a safe haven investment asset, to check its safe haven property, its volatility was analyzed using three set of panel data. Bitcoin and other cryptocurrencies hold the revolutionary importance in the digital financing. The purpose of Bitcoin was to use it as trading, but it brings out as an asset also. Russia – Ukraine war just begin after Covid – 19 pandemics, several studies has been carried out on the effect of Covid on Bitcoin. Since its launch in 2008, the Bitcoin market has presented both significant opportunities and challenges to investors, decision-makers, economists, and other crypto-currency users.

The primary objective of the study is to analyze whether Bitcoin maintain its position of safe haven

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asset in the war time, taking Russia – Ukraine war as a case under study. Bitcoin user mostly treat it as a speculative asset rather than a medium of exchange. Bitcoin and gold hold some similar nature to some extent, both are scarce and hard to extract, none of them have any country on their back. Gold was used as a medium of exchange in early times, just as same as Bitcoin which were initially used as trading now regarded mostly as an asset. Karl Whelan (Whelan, 2018) consider Bitcoin as similar as Dollar, since both possess intrinsic value and both are used as medium of exchange, but Dollar is back by government whereas Bitcoin does not have any regulatory authority. Bitcoin market although start its journey from 2008 but it is still not as much mature that investor consider it as a safe option in the period of war. Since the creation of the Bitcoin currency, experts and researchers have focused a lot of attention on the currency's risk-avoidance capabilities and its volatility during several events.

When defining volatility, GARCH (Generalized Autoregressive Conditional Heteroskedasticity) extensions are thought to be more appropriate (Bollerslev et al. 1993). These models effectively capture the properties of time series data using historical estimation mistakes to describe the volatility of the conditional variance. As a result, we can account for the leverage effect, the responsiveness to war and operational breaks, the volatility clustering (the sum of the ARCH and GARCH effects), and the temporary and permanent components.

The paper proceeds as follow: Section 2 provide some theoretical background of Bitcoin in context of previous studies. Section 3 includes the methodological prospective of the study. Section 4 present the data analysis and empirical finding of Bitcoin prices along with gold, oil, S&P 500, and exchange rates (Euro, Ruble, and Ukrainian Hryvnia) and last but not the least Section 5 summarize the main finding with remarks.

2. Literature Review

Before 2008, no one was aware about the word Bitcoin. Satoshi Natamoto (an unknown identity) was the first who introduce it in his article (Borchardt et al., 2014). It is an electronic peer to peer payment system that allow buyer and seller to transact directly with each other without involving any other party like bank or other financial institutions. In past, gold was used as medium of exchange, but now it works as commodity. Bitcoin was invented as for medium of exchange, for trading over network, but its properties indulge it as an asset. (Baur et al., 2018) provide sufficient evidence in this regard and hold that, bitcoin is a speculative asset with safe haven properties, rather a medium of exchange like fiat currencies. But indeed, gold have physical existence unlike bitcoin, which is a file saved on a PC in a digital wallet, it is a digital asset.

Bitcoin, according to (Whelan, 2018), is similar to fiat currency like dollar, both hold same characteristics e.g. medium of exchange and limited or no inherent value. But the main difference is that of a regulatory body, dollar is backed by US government to whom people are aware and hence trusted whereas bitcoin is privately created currency having no central authority and nor back by a government.

Bitcoin from its introduction has experienced the highly fluctuated and volatile cryptocurrency. Previous studies have worked out on Bitcoin volatility in different cases like price crash (Bouri & Azzi, 2017), COVID – 19 (Salisu & Ogbonna, 2021) and Geopolitical risk (Aysan et al., 2019). (Borchardt et al., 2014) measured bitcoin volatility with other currencies using major exchange rates, and found that bitcoin is highly volatile compare to other currencies on that time. (Bouoiyour, 2015) analyze the bitcoin volatility with News data and found that Bitcoin volatility was more vulnerable for negative shocks (Bad News) compare to positive shocks (Good News).

Bitcoin trading trend represent highly volatility as compare to commodities like gold and currencies like USD. In order to analyze bitcoin volatility Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is appropriate to use (Bouoiyour and Selmi, 2016; Bouri et al., 2017; Dyrberg, 2016). Bitcoin fall in between a commodity like gold and a fiat currencies , due to its un-regulatory nature and limit of market length (Dyrberg, 2016). Some properties of bitcoin suggest that its similar to that of a gold, having similar hedging capabilities and influence symmetrically towards good and bad news. Most of the bitcoin users regard bitcoin as speculative assets, rather the medium of exchange. As a result, bitcoin may be more regarded as an asset rather than currency.

One of the studies (Yarovaya et al., 2021) suggest that cryptocurrency market does not affect by the herding behavior of investor during the period of pandemic, which is against the belief about relationship between herding and uncertain events. (Salisu & Ogbonna, 2021) analyzed the news impact on Bitcoin rate during the pandemic period and find the positive relationship between digital currency and news in the said period, it makes doubt in the regard that bitcoin possess safe haven property. Cryptocurrencies should not be considered a kind of gambling, but rather a legitimate investment vehicle (Dahham & Ibrahim, 2020).

During the financial and economic crises. investor tend to convert their wealth from stock market to bitcoin market, if the prices of stock rises, they tend to sell bitcoin and purchase the stock, this shows that bitcoin regard as safe haven during uncertainty period. The expected rise in volatility would increase the needed rate of return on stock, causing the price of equity to fall. (Bouri & Azzi, 2017). bitcoin represent the decentralized alternative monetary system in such situations. (Popper, 2015) regard bitcoin as a digital gold. Investors take an increase in gold prices during bearish market movements as a sign that the macroeconomic climate is becoming more uncertain, which makes the gold market more volatile and uncertain. The war begins just after Covid – 19 pandemics, which drive people to go virtually (Online trading, online Education etc.). The changing trend from physical to virtual gives more importance to the digital financing.

(Umar et al., 2021) analyze the role of bitcoin as the safe haven during the period of uncertainty in the politics and economics in US and found bitcoin as safe haven when uncertainty prevail in the economy. Bitcoin users are more stimuli for the gain than for losses. (Oad Rajput et al., 2022) found the negative relationship between bitcoin prices and USD exchange rate. The inverse relationship of bitcoin with its sentimental index is due to investor's belief on hold-more gesture which effect formation of clamor in bitcoin market. A safe-haven property may be indicated by any indication of a good return-volatility relationship in the Bitcoin market. Such proof can be used to increase the value of Bitcoin as a protection against volatile equity markets (Dyrberg, 2016).

During the war time, central bank issue currencies which lead to increase the supply of money causing decrease its value and increase the inflation, but in case of bitcoin, having fixed quantity of 21 million coins it resists devaluation of coin value. The primary objective of this study is to analyze the impact of Russia – Ukraine war on Bitcoin volatility. (Su et al., 2020) analyze the impact of geopolitical events on Bitcoin prices and found positive effects of these vents on Bitcoin. (Aysan et al., 2019) also affirm that Bitcoin can be regarded as hedging tools against uncertain global events.

The study of (Tosun & Eshraghi, 2022) analyze the corporate decision and market behavior during the military conflict period taken Russia – Ukraine war as a case and found negative relationship between military operation on the firm's financial position. Finance literature also suggested the same, World War II left deep impact on the financial aggregation of the firms worldwide. After 24 Feb 2022 Russian Invasion, sanctions were imposed on the firm for cut of their business operation,

the finding evident that trading volume of the left-over companies were high due to selling pressure in Russia.

The previous studies reveal that at the time of geopolitical uncertainty, investor tend to sell their financial assets, like stocks and bond(Aysan et al., 2019). The capital then put into the crypto market as investor can consider it as a hedge against risk, thus concluded that uncertain events is likely to have a positive effect on cryptocurrencies. (Caldara & Iacoviell, 2022) define the geopolitical uncertainty as the “risk associated with wars, terrorist acts, and tension between states that affect the normal and peaceful causes of international relations”.

The aim of this study is to analyze how volatile the prices of Bitcoin during the war time (Russia – Ukraine War), GARCH model was used to analyze the impact of Russia – Ukraine war on Bitcoin prices. Other variables also added to check viability between the relationship, Exchange rates (USD-EUR, USD-UAH, USD-RUB), gold prices in USD, oil prices in USD and S&P 500 were used for this purpose.

The ARCH or Autoregressive Conditional Heteroskedasticity method provides a way to analyze a change in prices of assets, in other words in analyze the volatility of an asset. An extension of this approach named GARCH or Generalized Autoregressive Conditional Heteroskedasticity allows the method to support changes in the time dependent volatility.

3. Methodology

The purpose of this study is to analyze the impact of Russia – Ukraine war of volatility of Bitcoin. The model used to analyze the impact of war on price (Bitcoin, Exchange rates (USD-EUR/USD-UAH/USD-RUB), gold prices, oil prices and S&P-500) is GARCH model with mean at first and then variance of the data. GARCH is a statistical modeling technique used to help predict the volatility of assets in time series data. (Bouoiyour, 2015) used GARCH family model to analyze the positive and negative shocks in Bitcoin prices. (Dyhrberg, 2016) also apply GARCH volatility model to study conditional variance pattern of Bitcoin, Dollar and Gold prices. (Katsiampa, 2017) suggest the GARCH model as an appropriate tool to find the volatility of the Bitcoin prices return. The conditional mean of returns using GARCH model:

Conditional Mean of Bitcoin Return

$$R_t = \mu + R_{t-1} + \varepsilon_t \quad \text{----- Eq (1)}$$

Conditional Volatility of Bitcoin Return

$$h_t = \omega + \alpha (\varepsilon_{t-1})^2 + \beta(h_{t-1}) + \varepsilon_t \quad \text{----- Eq (2)}$$

In Eq. (1), R_{t-1} is the daily closing prices of Bitcoin, Gold, Oil, S&P 500, Exchange rates (USDEUR, USDRUB, USDUAH) takes into account with the three set of Panels: (Panel A = Entire period, Panel B = Before war period, and Panel C = During war period).In Eq. (2), ω is the constant volatility, α represents the ARCH term which measures the impact of past innovations on current variance, β represents the GARCH term which measures the impact of past variance on current variance, ε is the error term, and γ captures any potential symmetric effect on the volatility of Bitcoin. The mean and variance equation of GARCH were adopted from (Bouri & Azzi, 2017). The asymmetric-GARCH model is estimated by the maximum likelihood approach under Student-*t*. GARCH (1,1) is used to analyze the volatility of selected variables

Panel-B produces more volatility than a panel-C if is significant and positive; in contrary, a panel-C produces more volatility than a panel-B of the same magnitude if is significant and negatively. The ensuing restrictions must be adhered to in order to guarantee stationarity and positivity: $\omega > 0$; $\alpha \geq 0$; $\beta \geq 0$; $\alpha + \gamma \geq 0$; $\alpha + \beta + 0.5\gamma < 1$. The GARCH model is estimated by maximum likelihood approach using student-t distribution.

4. Data Analysis And Finding

The data used are the daily closing prices in USD of Bitcoin, Exchange rates (USD-EUR/USD-UAH/USD-RUB), gold prices, oil prices and S&P-500 from 24 September 2021 to 24 May 2022. We use the WinkDex data as the daily exchange rate of Bitcoin to US dollar (USD) from the WinkDex website (<https://winkdex.com/>).

4.1 Heteroscedasticity test: ARCH

In an ARCH test, the F-statistic is used to assess the presence of conditional heteroskedasticity, which indicates whether the volatility of a time series varies over time.

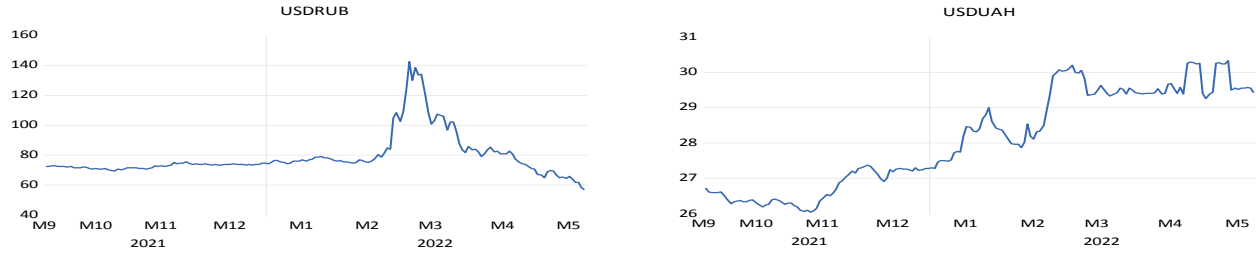
F-Statistic	168.8724	Prob. F (1,170)	0.0000
Observe R-Squared	85.71383	Prob. Chi-Square (1)	0.0000

In the context of an ARCH test, the F-statistic of 168 indicates evidence of conditional Heteroskedasticity in a time series, which means that the volatility of the series varies exist over time.

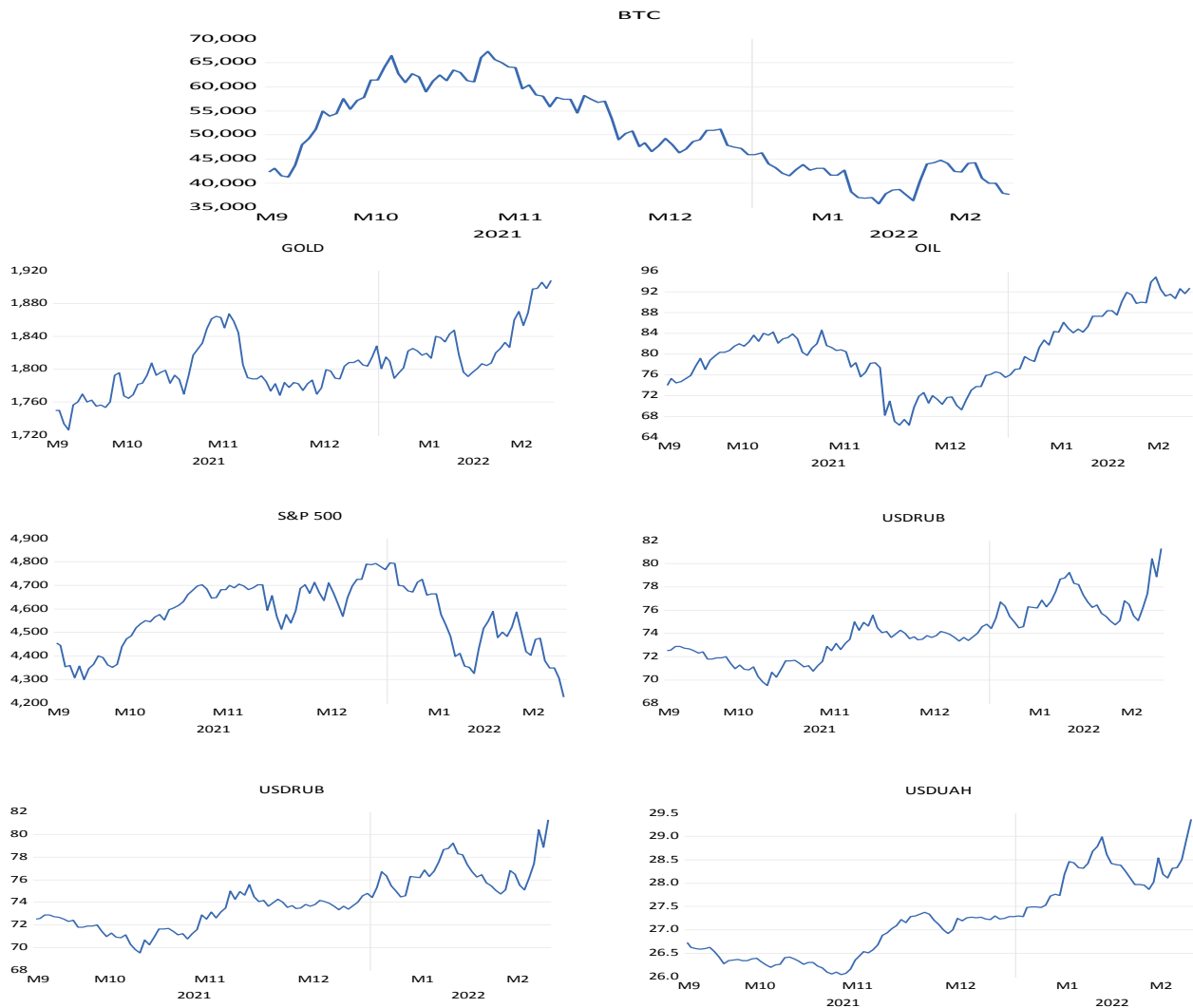
PANEL A: ENTIRE PERIOD (24 SEPTEMBER 2021 – 24 MAY 2022)



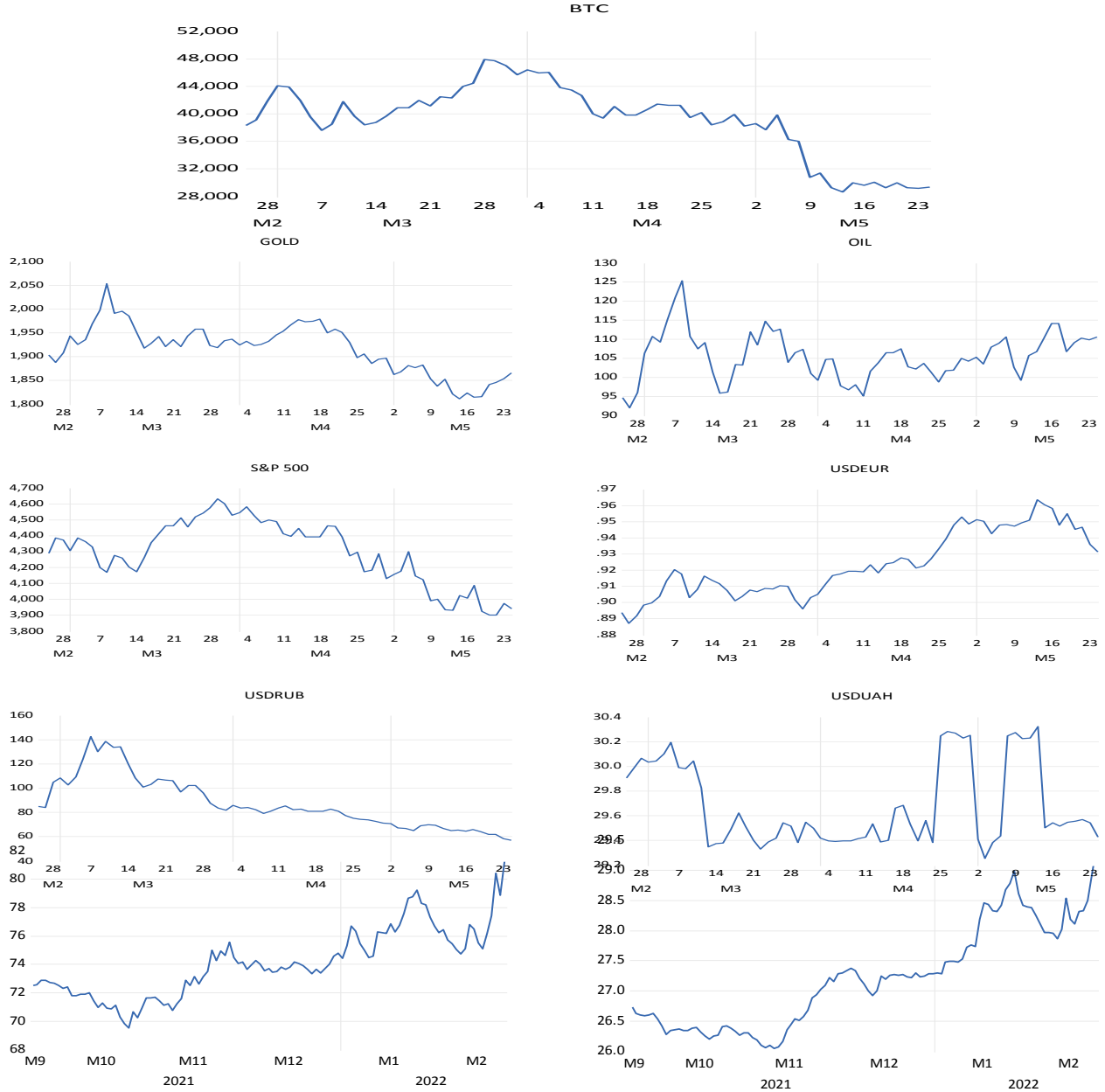
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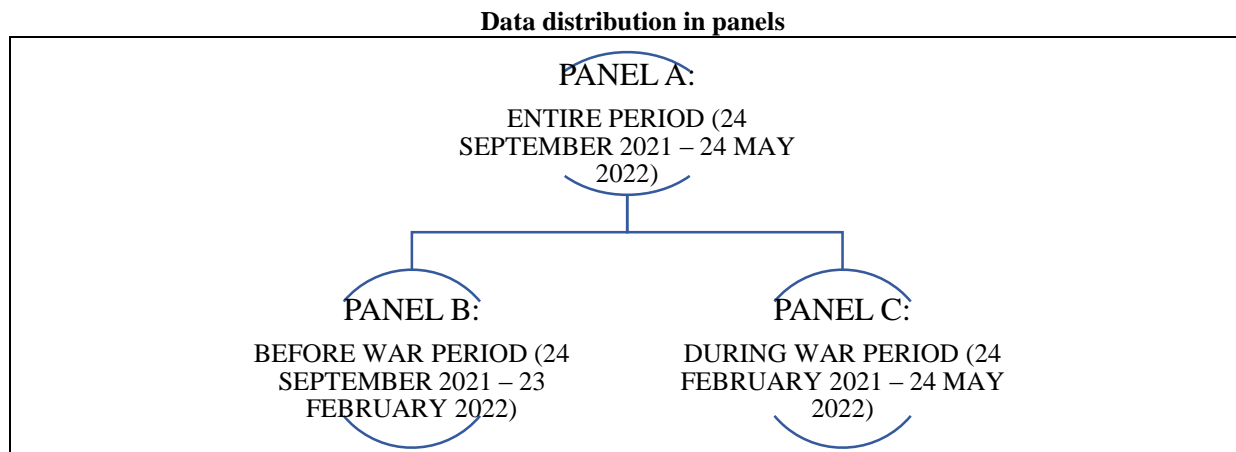
PANEL B: BEFORE WAR PERIOD (24 SEPTEMBER 2021 – 23 FEBRUARY 2022)



PANEL C: DURING WAR PERIOD (24 FEBRUARY 2021 – 24 MAY 2022)



Data were set in 3 panels, first Panel A: 6 months data (24 September 2021 to 23 May 2022) regarded as Entre time period, second Panel B: 3 months data (24 September 2021 to 23 February 2022) regarded as pre-war data and third Panel C: 3 months data (24 February 2022 to 24 May 2022) regarded as during Russia – Ukraine war data.



From the summary statistics of descriptive data (Table – 1) in Panel A, Bitcoin shows high standard deviation (\$9417.99) compare to all other variables, low Jarque – Bera and high Range between Maximum and Minimum value. The data were analyzed using 173 observations. In Panel B, standard deviation of Bitcoin still on high in the prior war time period, but Range was comparatively low to that of entire time periods observations, this panel contain 109 observations. In Panel C, standard deviation of Bitcoin shows \$5239 and stood as high as compare to the other variables of the study, this panel contain 64 observations. The data reveal that, during the war time, the Bitcoin prices were goes on its minimum with negative skewness, in the Panel C whereas in Panel B the skewness of the Bitcoin were positive.

TABLE 1 SUMMARY STATISTICS OF BITCOIN/EXCHANGE RATES/GOLD/OIL/S&P – 500 DAILY RATES IN USD

	N	MEAN	STD. DEV	SKEWNES	KURTOSIS	JARQUE-BERA	MAX	MIN
PANEL A: ENTIRE PERIOD (24 SEPTEMBER 2021 – 24 MAY 2022)								
BITCOIN	173	46115.65	9417.989	0.456905	2.472024	8.028705	67310.74	28649.82
GOLD	173	1846.966	68.80084	0.597382	2.373878	13.11548	2052.410	1726.110
OIL	173	89.62749	13.93795	0.325523	1.965381	10.77139	125.4050	66.25500
S&P 500	173	4464.684	212.1294	-0.738980	3.080360	15.79220	4796.560	3900.790
USD-EUR	173	0.893989	0.027280	0.794964	2.757344	18.64612	0.963500	0.853200
USD-RUB	173	78.99369	14.47821	2.404564	9.053344	430.8470	142.6404	57.14960
USD-UAH	173	28.12438	1.381796	0.036879	1.522087	15.78385	30.32080	26.05150
PANEL B: BEFORE WAR PERIOD (24 SEPTEMBER 2021 – 23 FEBRUARY 2022)								
BITCOIN	109	50234.47	8886.348	0.224764	1.781362	7.662489	67310.74	35741.11
GOLD	109	1806.618	37.29308	0.677453	3.317288	8.794676	1907.550	1726.110
OIL	109	80.27904	6.917729	0.052114	2.361417	1.901379	94.82500	66.25500
S&P 500	109	4565.182	141.9654	-0.362013	2.019093	6.750699	4796.560	4225.500
USD-EUR	109	0.876503	0.010865	-0.448555	1.975223	8.424678	0.897400	0.853200

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USD-RUB	109	74.08874	2.395096	0.505192	2.998832	4.636479	81.27680	69.51850
USD-UAH	109	27.21037	0.834297	0.476601	2.188128	7.120108	29.36550	26.05150
PANEL C: DURING WAR PERIOD (24 FEBRUARY 2021 – 24 MAY 2022)								
BITCOIN	64	39100.78	5239.053	-0.668865	2.655855	5.087887	47888.39	28649.82
GOLD	64	1916.705	51.93592	-0.198362	2.708547	0.646226	2052.410	1811.150
OIL	64	105.5491	6.294150	0.371399	3.642976	2.573779	125.4050	91.94500
S&P – 500	64	4293.523	202.6546	-0.414904	2.133104	3.840236	4631.600	3900.790
USD-EUR	64	0.923770	0.019984	0.286802	1.922353	3.974252	0.963500	0.887100
USD-RUB	64	87.34745	21.21179	0.880196	3.038825	8.267965	142.6404	57.14960
USD-UAH	64	29.68104	0.335500	0.744357	1.941633	8.897093	29.53840	29.25420

The Coefficient estimation of the GARCH (1,1) model – mean equation (Table – 2) for Panel A shows that Bitcoin constant is positive and statistically significant with high value of 462.91. Except bitcoin all constants are below 108. The average price of bitcoin is 462.91 and its past value significantly predicts the current series by 0.99. In Panel B, the value of constant becomes 1036.83, while in Panel C, it becomes 1839.99 which is high and shows maximum average in the given period.

TABLE 2 COEFFICIENT ESTIMATION OF THE GARCH MODEL – MEAN EQUATION

	Constant	R_{t-1}
PANEL A: ENTIRE PERIOD (24 SEPTEMBER 2021 – 24 MAY 2022)		
BITCOIN	462.9074	0.988587
GOLD	63.73941	0.965827
OIL	1.765986	0.982576
S&P – 500	107.0351	0.975902
USD-EUR	0.011342	0.987536
USD-RUB	2.312446	0.968099
USD-UAH	-0.041311	1.001635
PANEL B: BEFORE WAR PERIOD (24 SEPTEMBER 2021 – 23 FEBRUARY 2022)		
BITCOIN	1036.832	0.980591
GOLD	65.36151	0.964635
OIL	3.226025	0.963723
S&P – 500	180.6469	0.961616
USD-EUR	0.061462	0.930202
USD-RUB	1.470582	0.979911
USD-UAH	-0.346818	1.012943
PANEL C: DURING WAR PERIOD (24 FEBRUARY 2021 – 24 MAY 2022)		
BITCOIN	1839.9901	0.952347
GOLD	110.9322	0.941697
OIL	28.51457	0.731502
S&P – 500	122.8072	0.970738
USD-EUR	0.066323	0.929015
USD-RUB	0.564320	0.979439
USD-UAH	4.270208	0.856155

Conditional Mean of Bitcoin Return:

$$R_t = \mu + R_{t-1} + \varepsilon_t$$

PANEL A: $R_{BTC} = 462.907 + 0.989 + 0.014$
PANEL B: $R_{BTC} = 1036.832 + 0.980 + 0.021$
PANEL C: $R_{BTC} = 1839.901 + 0.952$

Table – 3 shows the coefficient estimation of the GARCH (1,1) model – variance equation, the variance coefficient (ω) is high as 2400007 in Panel C (during the war time period) compare to 1918944 in Panel B (prior war time period) which indicate that bitcoin could not sustain its position and price move on downward trend. Coefficient of the constant variance term, the ARCH and GARCH parameter of bitcoin prices are highly positive and statistically significant at the 1% level of significance using student – t test. This gives the result of GARCH model, the time-varying volatility includes a constant ω (Panel A = 3204521, Panel B = 1918944 and Panel C = 2400007) plus its past term $\beta(ht-1)$ (Panel A = 0.050, Panel B = 0.597, and Panel C = -0.007) and a component which depends on past error $\alpha(\varepsilon t-1)^2$ (Panel A = -0.036, Panel B = -0.112, and Panel C = -0.081). The finding clearly establishes the presence of time-varying conditional volatility of the prices of bitcoin during the war times. This results also indicate that in Panel C of the Table – 3, the persistence of volatility of bitcoin, as represented by the sum of the ARCH & GARCH parameters is large. The price of bitcoin in period of were not stable and also shows intense volatility.

TABLE 3 COEFFICIENT ESTIMATION OF THE GARCH MODEL – VARIANCE EQUATION

	Constant	$\alpha(\varepsilon t-1)^2$	$\beta(ht-1)$
PANEL A: ENTIRE PERIOD (24 SEPTEMBER 2021 – 24 MAY 2022)			
BITCOIN	3204521	-0.036559	0.050299
GOLD	276.0372	0.210116	-0.334260
OIL	0.214588	0.187114	0.819156
S&P – 500	4385.040	-0.060523	-0.332350
USD-EUR	0.00000116	-0.037578	1.039816
USD-RUB	0.021252	0.378540	0.737259
USD-UAH	0.000217	-0.053586	1.037196
PANEL B: BEFORE WAR PERIOD (24 SEPTEMBER 2021 – 23 FEBRUARY 2022)			
BITCOIN	1918944	-0.112251	0.597133
GOLD	8.046794	-0.092497	1.044789
OIL	0.321574	0.050878	0.830271
S&P – 500	53.55472	0.183927	0.822607
USD-EUR	0.0000111	0.149999	0.599997
USD-RUB	0.017386	0.289523	0.759483
USD-UAH	-0.000249	-0.042506	1.094099
PANEL C: DURING WAR PERIOD (24 FEBRUARY 2021 – 24 MAY 2022)			
BITCOIN	2400007	-0.081258	-0.007255
GOLD	601.7388	0.314694	-0.841916
OIL	0.003955	-0.101388	1.102900
S&P – 500	4739.084	-0.168424	0.186725
USD-EUR	0.0000225	-0.097298	0.305913
USD-RUB	0.069358	-0.112151	1.069451
USD-UAH	0.666695	0.796103	-0.266071

Conditional Volatility of Bitcoin Return

$$h_t = \omega + \alpha (\varepsilon_{t-1})^2 + \beta (h_{t-1}) + \varepsilon_t$$

PANEL A: $h_{BTC} = 3204521 - 0.037 + 0.050$

PANEL B: $h_{BTC} = 1918944 - 0.112 + 0.597$

PANEL C: $h_{BTC} = 2400007 - 0.081$

5. Discussions & Conclusion

This paper explores the volatility of bitcoin in the war times of Russia – Ukraine, in order to analyze whether or not bitcoin could sustain its position of safe haven. The Bitcoin market has recently been found with huge growth in term on investment and have provide reasoning for examining its volatility. The study provides several contributions to the existing literature as well as to the potential investors who might be interested in trading or investing in the Bitcoin market during the war time.

This study is the first attempt to explore the war impact on bitcoin volatility and analyze whether bitcoin is able to maintain its safe haven property in the war time. For the purpose of this study, we use GARCH model using E-Views to analyze the volatility of bitcoin. For checking consistency, other financial sectors were also employed included Gold, Oil, S&P 500 and Exchange rate prices of the same period.

The finding reveals that bitcoin does not maintain its property of safe haven during the war time of Russia – Ukraine as the persistence of volatility of Bitcoin, sum of ARCH and GARCH parameters is very large and its unstable and volatile nature stimuli that it's not safe for active investor to invest in Bitcoin market for the short run.

We distribute the data in three panels, Panel A (Entire period having 173 observations), Panel B (Before war period having 109 observations), and Panel C (During war period having 64 observations). At the time of study war has not yet over therefore after war period could not be taking into the account. Further studies could be carried on long run context taking more observations in the study.

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