Is Bitcoin a Safe-haven Against Geopolitical Events: An Analysis Based on Russian-Ukrainian Conflict

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Abstract. Bitcoin, as a virtual cryptocurrency with both property of investment and currency, is widely investigated for its potential as a safe haven in world volatility. This paper, using classic time series model VAR and ARMA-GARCH, aims to study whether Bitcoin has safe-haven value in geopolitical events, which is based on the Russia-Ukraine conflict. By quantifying the impact of Russia-Ukraine conflict with crude oil prices and considered logarithmic yield, this study finds out both the positive and negative effects to Bitcoin yield from temporary shocks and long-term fluctuations of geopolitical. The VAR accumulation shows that geopolitics will have cumulative net positive impacts on Bitcoin's yield in the short term, that is, Bitcoin can be seen as a short-term safe haven for investors with brief profit needs. However, more results show that the impact of geopolitics on Bitcoin is difficult to determine, and the long-term impact is close to zero. The inadequate evidence of safe-haven value means that long-term investors need to consider Bitcoin cautiously. Based on the current background of Russia-Ukraine conflict, the study can both promote the academic understanding of Bitcoin's value in geopolitical conflict, and help the investors make the right choice in world volatility.

Keywords: Bitcoin, Geopolitical, Safe haven, VAR, ARMA-GARCH.

1. Introduction

Bitcoin is a virtual cryptocurrency that exists independently of national sovereignty. Nakamoto [1], who came up with Bitcoin firstly, defined it as a new financial asset that could enable personal payment transactions that vault financial institutions and intermediary. Bitcoin's price is determined in a particular way. The theory of price determination in economics is mainly divided into value determinism like Marx's theory [2] and supply and demand determinism like Hume's mechanism [3], Fisher's equation [4], Marshall's currency theory [5], etc. Bitcoin, as a dual asset with currency and investment attributes, affects by both value and supply and demand. On the one hand, as virtual currency, Bitcoin's value is affected by the reliability of the trade technology "block-chain". On the other hand, as an investment product, it is also affected by investors' speculative psychology and the relationship between supply and demand in the Bitcoin market.

Because of the peculiarities of its pricing, Bitcoin's ability to act as a safe haven in period of world volatility is controversial. As per Baur and Lucey [6], a safe haven means when the yield of an asset shows no correlation or negative relationship with extreme volatility, which manifests as stable or rising yields when facing fluctuations and plays an important role in volatile conditions like the Internet bubble, the subprime crisis, the COVID-19, the trade war and the geopolitical conflict.

In recent years, with the rise of Bitcoin investment boom and the constant exposure of Bitcoin volatility, the research on Bitcoin is more and more extensive. There are two main areas of research. One is the nature of Bitcoin itself, including its real value, how it is priced, the size of the bubble and so on. The other is the nature of Bitcoin in an environment of volatility and conflict, that is, whether it has the function of hedging risk or acting as a safe-haven currency.

About the properties of Bitcoin, many studies have argued that Bitcoin is not a traditional currency. Yermack [7] believes that the prices containing speculative component is the characteristic of speculative assets, not traditional currency or stable assets. Both Selgin [8] and Baek & Elbeck [9] agree with the perspective that Bitcoin is a speculative commodity similar to stocks and securities. Cheah and Fry [10] even think that Bitcoin is worth nothing with price full of bubbles, so as Corbet et al. [11] who studies the fundamental drivers of Bitcoin price and proposed an obvious bubble

behaving in Bitcoin. While, there are still studies taking different approaches. Shahzad et al. [12] indicates Bitcoin as an asset with both speculative property and traditional currency property.

Currently, more research has focused on whether Bitcoin has the properties of a hedge or safe haven against volatility and uncertainty.

On one hand, it is surprising that although the speculative nature of Bitcoin has been emphasized by most studies, there is still abundant of research linking Bitcoin with the ability of safe haven and hedge. Demir et al. [13] emphasize that while Bitcoin yield is negatively correlated with the uncertainty of economic policy generally, both higher and lower quantiles of Bitcoin yields have a significantly positive effect when considering quantiles. As a result, they considered Bitcoin as a hedge against volatility. Bouoiyour [14] compared the differences between Bitcoin, oil and precious metals, believing that Bitcoin has the safe-haven nature when facing presidential election uncertainty. Antonakakis et al. [15] explored the hedging properties of a portfolio constructed with two cryptocurrencies and found that it could generate potential hedging returns for investors. Mamun et al. [16] investigates the influence of geopolitical risk towards the structure of Bitcoin and finds that geopolitical conflicts command a risk premium in Bitcoin, particularly in distress conditions. There are some examples that can prove the results in Mamun research, which include the fluctuations of Bitcoin prices in Belgium frequent terrorist attacks and the 2016 Brexit.

On the other hand, some aforementioned studies indicate contrary perspective that their are little evidence to prove the safe-haven property of Bitcoin. Naeem et al. [17] manifest that the efficiency of cryptocurrencies such as Bitcoin have unstable fluctuations over time, especially when facing uncertainty like COVID-19 which has adversely affected on Bitcoin yield. Matkovskyy and Jalan [18] suggest that during the global crisis, investors with risk aversion psychology are more likely prone to purchasing investments safer than Bitcoin, the risky one. Charfeddine et al. [19] ascertain that Bitcoin is generally regarded as an inefficient hedging currency. Jareño et al. [20] also indicate that the effects of the fluctuations of volatility index are significantly negative on the Bitcoin price in statistics.

Neutral perspectives also exist in studies of this theme. Qin et al. [21] emphasize both the positive and negative effects that the uncertainty global economic policies have on Bitcoin price, same as Su et al. [22]. In these views, Bitcoin cannot be completely regarded as a safe haven for its property is instability and inconstant.

Overall, recent researches on Bitcoin mainly focus on its properties and its hedge value. As for the property of Bitcoin, the main view indicates that Bitcoin has strong speculative property with price bubble. Interestingly, there is debate about whether Bitcoin has the property of a safe haven. Some scholars believe that Bitcoin has the value of hedging against the risk of economic fluctuations. Some scholars ascertain that the speculative property of Bitcoin is prominent under economic fluctuations, and investors will sell Bitcoin and choose safer assets out of risk aversion. The remaining scholars propose that there is not enough evidence to get a clear conclusion on this issue.

Since the conflict between Russia and Ukraine broke out in early 2021, geopolitical issues have come to the fore, and Russia, as a large exporter of crude oil, is efficient and convenient to choose crude oil price for measuring the degree of conflicts. Therefore, based on the geopolitical background of the Russia-Ukraine conflict, the study on whether Bitcoin can be used as a safe-haven currency under geopolitical issues is helpful to promote the progress of the research on the safe-haven value of Bitcoin and provide some actual evidence for the academic community.

The rest of this paper is structured as follows: information about the data source, data stationary test, and the empirical models is covered in Section 2. Section 3 comes next, with an adequate discussion of the VAR and ARMA-GARCH model empirical results. Following that, Section 4 discusses the similarities and differences between the research conclusions and the existing literature, also the enlightenment and application of the results. Finally, Section 5 summarize the main conclusions.

2. Research Design

2.1. Data Source

The degree of geopolitical conflict often requires to be quantified by other variables. This paper uses the price of crude oil to measure the volatility of Russian-Ukrainian geopolitical conflict. Russia is a major exploiter and exporter of crude oil. The conflict between Russia and Ukraine has disrupted exports and increased demand of oil due to the use of weapons and machinery, leading to a spike in oil price. Therefore, to some extent, the rise of oil prices can reflect the size of the geopolitical fluctuations in the Russia-Ukraine conflict.

In order to enhance representation, this paper selects Brent and WTI crude oil price respectively. WTI and Brent are among the world's three major oil benchmarks. The WTI, a light crude from West Texas, is seen by many investors as a benchmark in international energy markets, but is heavily influenced by local supply and demand. Brent, however, as a light sweet crude oil produced in the Brent, is traded in the market of futures, forward and spot widely, and has price stably with little influence by its origin.

The study extracted daily closing prices of WTI and Brent crude oil spot and Bitcoin stock from June 1, 2021 to November 25, 2022. The main reasons for choosing June 2021 are as follows: First, the Russia-Ukraine conflict began in the first half of 2021, and there is a certain hysteresis in the transmission from geopolitics to crude oil price fluctuations. Second, on May 31, 2021, the EU reached a compromise agreement to ban the import of Russian oil, and announced that the import of Russian oil will be cut by about 90% at the end of 2021 [23]. This move had a huge impact on the supply of crude oil and the price of crude oil, which was greatly affected by the conflict between Russia and Ukraine since that day. Due to the ongoing conflict between Russia and Ukraine, the data selected in this paper have been continued until November 25, 2022, before the start of the study.

In order to limit the effect of outliers, reduce the heteroskedastic or skewed degree, the study process the logarithm of data based on the formula price=ln(1+p). Because of the different trading cycles between the market of crude oil spot and the Bitcoin, there are some missing values in the data set, but having little impact on the results. Therefore, this paper choose to eliminate all missing values, leaving the closing prices of crude oil and Bitcoin from Monday to Friday, a total of 463 periods of data.

2.2. ADF Test

ADF tests the stationary of the time series data, which is the prerequisite of proceeding. Based on the ADF test conducted in Stata, the p-values in Table 1 for price of Bitcoin, WTI and Brent crude oil after logarithm are all greater than 0.1, or even greater than 0.5, which is considered not significant that study can't reject the hypothesis of unit root.

Therefore, this paper subtracts the logarithmic price and consider the logarithmic rate of return, which follows the formula ln(yield)=ln(price2)-ln(price1). The p-values in Table 1 for yield of Bitcoin, WTI and Brent crude oil after logarithm is close to 0.000, considering as statistically significant. Due to these findings, evidence is enough to prove the the data are stationary and the model is feasible.

Table 1. ADF test

Variables	t-statistic	p-value
Price		
Bitcoin	-2.040	0.5797
WTI	-1.445	0.8473
Brent	-1.623	0.7832
	Yield	
Bitcoin	-15.229	0.0000***
WTI	-15.850	0.0000***
Brent	-15.909	0.0000***

2.3. Vector Autoregression (VAR) Model

The VAR model applied first by Sims [24], combining the linear stochastic difference equation [25] and auto-regression model [26]. It is usually used to estimate the dynamic relationship of joint endogenous variables, which is achieved by using all the current and some of the lag variables in the model to carry out regression and self-regression. This study constructs three equations with three time series variables donated by $bitcoin_t$, wti_t, and $brent_t$.

$$bitcoin_t = \alpha_1 + \sum_{i=1}^{p} \emptyset_{1i} bitcoin_{t-i} + \sum_{j=1}^{p} \beta_{1j} wti_{t-j} + \sum_{k=1}^{p} \delta_{1k} brent_{t-k} + e_{1t} \quad (1)$$

$$wti_t = \alpha_2 + \sum_{i=1}^{p} \emptyset_{2i} wti_{t-i} + \sum_{j=1}^{p} \beta_{2j} bitcoin_{t-j} + \sum_{k=1}^{p} \delta_{2k} brent_{t-k} + e_{2t} \quad (2)$$

$$brent_t = \alpha_3 + \sum_{i=1}^{p} \emptyset_{3i} brent_{t-i} + \sum_{j=1}^{p} \beta_{3j} bitcoin_{t-j} + \sum_{k=1}^{p} \delta_{3k} wti_{t-k} + e_{3t} \quad (3)$$

To clarify, in equation (1), $\sum_{i=1}^{p} \emptyset_{1i} bitcoin_{t-i}$represents a linear function of past lags of Bitcoin yield in logarithm, while $\sum_{j=1}^{p} \beta_{1j} wti_{t-j} + \sum_{k=1}^{p} \delta_{1k} brent_{t-k}$ represent past lags of WTI and Brent crude oil yield in logarithm, and e_{1t} is the error term. As a result, the variable Bitcoin yield is modeled using historical values of itself and other two variables (WTI and Brent yield). Similarly, the structures of the remain equations have same explanation method with different variables and corner mark on both side of the equations.

2.4. ARMA-GARCH Model

The ARMA-GARCH model can evaluate both the return and volatility of the Bitcoin yield. The model combines the formula and advantages of ARMA and GARCH, where the former is used to estimate the mean of yield and the latter to forecast fluctuations.

2.4.1 ARMA

The ARMA model uses both historical realization values and past volatility to estimate the future. The ARMA model constructed in this paper is as follow.

$$bitcoin_t = \emptyset_0 + \sum_{i=1}^{p} \emptyset_i bitcoin_{t-i} + \alpha_t - \sum_{i=1}^{q} \theta_i \alpha_{t-i} \quad (4)$$

From equation (4) above, $\sum_{i=1}^{p} \emptyset_i bitcoin_{t-i}$, the AR(p), represent the historical value of Bitcoin log yield to estimate the future return, while $a_t - \sum_{i=1}^{q} \theta_i a_{t-i}$ as the MA(q), forecasts the future volatility that deviates from expectations.

2.4.2 GARCH

GARCH model is a simplification and improvement of ARCH model, developed by Bollerslev (1986). It predicts conditional variance through historical residual value and historical conditional variance value. Here is GARCH model constructed.

$$\sigma_t^2 = \beta_0 + \beta_i \varepsilon_{t-1}^2 + \gamma_j \sigma_{t-1}^2 \quad (5)$$

In equation (5), GARCH (1,1) was taken into account, as for selecting GARCH (1,1) is ample to effectively identify most fluctuation [27] and fits the features of time series [28]. The term $\beta_i \varepsilon_{t-1}^2$ is ARCH part, using the historical residual value of Bitcoin's yield to forecast, while $\gamma_j \sigma_{t-1}^2$ is the GARCH part with auto-regressive property.

3. Empirical Results and Analysis

3.1. VAR Order

The optimal lag order of VAR model can be identified by several statistics such as LR, PFE, AIC and others. The following is the result of identification.

Table 2. VAR model identification

Lag	LL	LR	DF	P	FPE	AIC	HQIC	SBIC
0	3,560.50				0	-15.8111	-15.8003	-15.7837*
1	3,582.57	44.1450	9	0.0000	0	-15.8692	-15.8260*	-15.7596
2	3,592.45	19.7620	9	0.0190	0	-15.8731*	-15.7975	-15.6814
3	3,594.10	3.2976	9	0.9510	0	-15.8405	-15.7325	-15.5665
4	3,607.09	25.9790	9	0.0020	0	-15.8582	-15.7178	-15.5020
5	3,612.23	10.2780	9	0.3280	0	-15.8410	-15.6683	-15.4027
6	3,620.04	15.6180	9	0.0750	0	-15.8357	-15.6306	-15.3152
7	3,633.28	26.4730	9	0.0020	0	-15.8546	-15.6170	-15.2519
8	3,639.62	12.6790	9	0.1780	0	-15.8427	-15.5728	-15.1579
9	3,650.27	21.3060*	9	0.0110	0	-15.8501	-15.5478	-15.0830
10	3,656.68	12.8270	9	0.1710	0	-15.8386	-15.5039	-14.9893
11	3,658.85	4.3342	9	0.8880	0	-15.8082	-15.4411	-14.8768
12	3,665.65	13.6080	9	0.1370	0	-15.7985	-15.3990	-14.7848

Table 2 reveals lags 9 in LR, 3 in FPE and AIC, 2 in HQIC and 1 in SBIC as the lag order. The paper selects LR statistics to determine the order, which represent the VAR order as 9. LR statistics approximately follow Chi-square distribution. Generally, when LR statistics are less than the critical value, it is considered that the lag order of VAR model is moderate. Choosing 9 as lag order is because other lag orders are too small, easily leading to the error term auto-correlation problem, which may cause the model parameter estimation error larger as a result.

The following figure verify the stationary of the VAR model, which prevents the impulse response function from converging to zero, that is, the effect from the fluctuations of crude oil price to Bitcoin is constant.

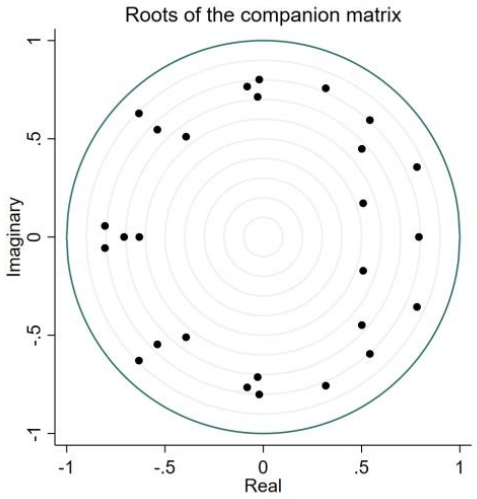

Figure 1. Unit circle test Photo credit: Original

According to Figure 1, all roots are clearly located within the unit circle, which means that VAR (9) is a stationary model.

3.2. Impulse Response

This study analyzes the impact of Bitcoin yield on new geopolitical impulses, Russia-Ukraine conflict, which are represented by WTI and Brent crude oil price yield respectively.

Theoretically, against the background of the Russia-Ukraine conflict, Europe's measures of banning the import of Russian oil directly resulted in the fluctuation of crude oil prices and economic

volatility. In such periods, there is a contradiction between the investment goods attribute and the currency attribute of Bitcoin yield.

From the perspective of investment, Bitcoin market has a high possibility of speculative commodity. Like many financial assets, its fundamental price (that is, value) is zero, and its price fluctuation depends on supply and demand, exhibiting speculative bubbles [29]. Therefore, in times of geopolitical conflict, the rise of crude oil price will increase people's living cost and decrease their expected disposable income in the future. Thus a large number of investors will flood out of the Bitcoin market for more current disposable income, resulting in the decline of Bitcoin price.

However, from the perspective of currency attribute, as a virtual cryptocurrency based on block-chain technology, the price of Bitcoin depends on the reliability of the currency, while the reliability mainly depends on block-chain technology. The advancement of block-chain technology promotes the stability of Bitcoin, as a result, people are more likely to choose Bitcoin as a safe-haven currency out of risk aversion when facing economic shocks with uncertain future living costs, so as to ensure that the value of their assets will not suffer huge depreciation in times of economic fluctuations.

Overall, the dual property of Bitcoin causes different to judge the direction of influence that crude oil price fluctuations have on the yield of Bitcoin. Therefore, the impulse response function is used in this part to investigate the effect.

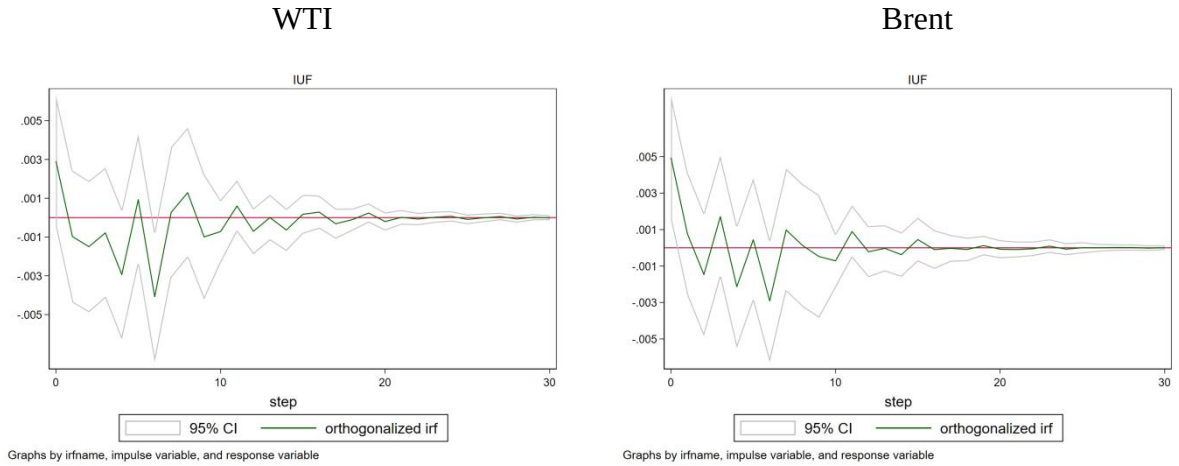

Figure 2. Impulse response Photo credit: Original

Figure 2 shows that the increase of WTI and Brent crude oil prices during the t=0 period leads to the fluctuation of Bitcoin yield in the future. As can be seen from the right figure, from t=0 period to t=2 period, the rise of Brent price has a short but significant impact from positive to negative on the Bitcoin yield rate. However, since t=3 period, the impact returns to positive. Above all, the direction of this influence is uncertain, but the degree of influence gradually shrinks and approaches to zero after t=15. The WTI price shock shown in the left figure is similar with the right, with the degree of impact approaching from large trend to 0 as time passed. The main difference between the two figures is that WTI's impact demonstrates a more clear direction in the short term. During the t=1 to t=4 period, the rise in WTI price has a temporary negative impact on Bitcoin's yield. Although the impact is positive in the period t=5, it changes into a more serious negative impact of about 0.4% in the period t=6. Until t=7, it turns into a uniform wave and an decline.

This paper speculates that the reason for the different results lies in the vary of two oil prices. WTI is the regional oil price in the United States, which mainly represents the price of Russian oil exports to the United States. Brent crude, however, is the benchmark oil in the European market, especially for Russia's Urals, which are mainly exported to European countries. The differences between European countries and America in the treatment of Russian oil in Russia-Ukraine conflict lead to the slight differences in the results of the two figure. However, the overall effect oscillates around zero and the net effect cannot be determined. Therefore, this paper further applies the cumulative response function to examine the influence (Figure 3).

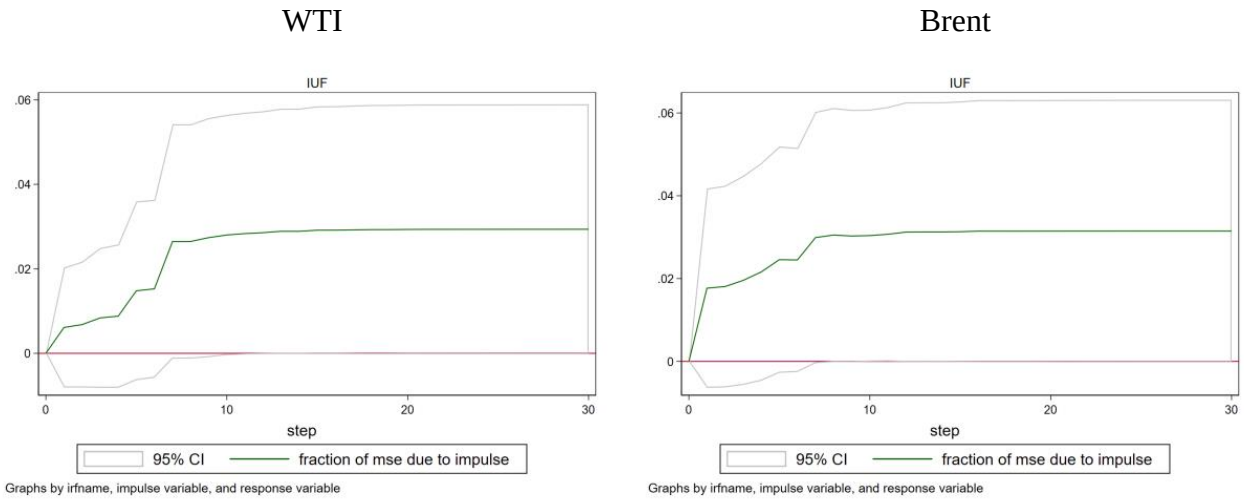

Figure 3. Cumulative response Photo credit: Original

From figure 3, it can be analyzed that the effects of WTI and Brent yields are very similar. During the period t=0, every 1 unit increase in WTI and Brent returns will have a gradually increasing cumulative impact on Bitcoin returns in the next 8 periods. After the 8th period, the cumulative impact is basically maintained at 3%. In other words, the positive impact of crude oil prices increase on the Bitcoin yield is short-lived but significant.

3.3. ARMA Specification

The PACF and ACF in figure 4 derive the lag orders for AR(p) and MA(q) of the Bitcoin yield in logarithm in model ARMA. Both the PACF and ACF demonstrates only 8 as the point beyond the critical values, representing both the values of p and q, the lag order of AR and MA, equal to 8.

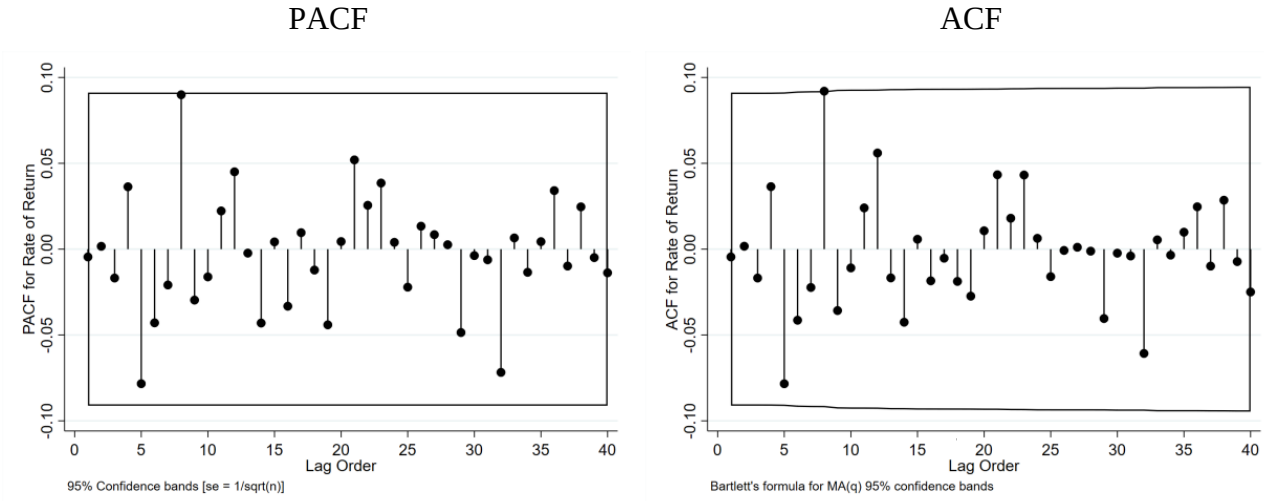

Figure 4. PACF and ACF Photo credit: Original

3.4. ARMA-GARCH Estimation Results

Based on the above test and order, the ARMA-GARCHX mode is built with AR(8) MA(8) to control the auto correlation of returns, the GARCH(1,1) to adequately capture the volatility in time series, and WTI and Brent logarithmic yields to explore the effects of Russia-Ukraine geopolitical conflict to Bitcoin.

Table 3. ARMA-GARCHX estimation results

	(1)			(2)		
	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|
Mean Equation						
AR, L8	-0.7170	0.1836	0.0000	-0.7172	0.1832	0.0000
MA, L8	0.7952	0.1580	0.0000	0.7953	0.1577	0.0000
Constant	-0.0014	0.0018	0.4430	-0.0014	0.0018	0.4430
Variance Equation						
WTI	-0.4520	1.5620	0.7720			
Brent				-0.5781	1.5925	0.7170
ARCH, L1	0.1269	0.0366	0.0010	0.1275	0.0367	0.0010
GARCH, L1	-0.3179	0.1777	0.0740	-0.3126	0.1763	0.0760
Constant	-6.3409	0.1737	0.0000	-6.3458	0.1732	0.0000

According to Table 3, the AR and MA are both significant at the level of 0.01 in (1) and (2), representing the sufficient of ARMA estimation. The ARCH terms in column (1) and (2) are all significant at the level of 0.01, and the GARCH terms are significant at the level of 0.1, which indicates that there is a conditional heteroscedasticity of the logarithm rate of return of Bitcoin, and GARCH modeling can be conducted.

The estimation results shows that the coefficients of WTI and Brent logarithmic yields are not significant, indicating that the change of crude yield have no significant influence on Bitcoin.

4. Discussion

As analyzed above, this paper explores the impulse function of WTI and Brent crude oil price yields on the logarithmic yields of Bitcoin through the VAR model. It is found that the abnormal rise of crude oil yield has a temporary but significant effect on Bitcoin. Cumulatively, the impact is positive and significant, with about 3% proportion of increase in Bitcoin resulted by unit increase in oil. However, when analyzed separately for each period, the influence direction of crude oil yield on Bitcoin fluctuations is unstable, and the impact gradually tends to stop over time. In contrast, through the ARMA-GARCH model, the fluctuation of crude yield has no obvious impact on the yield of Bitcoin continuously.

Therefore, the study believes that the impact of the Russia-Ukraine war has not clear. Although the cumulative positive impact is dominant in the short term by VAR, the overall effect is still uncertain, and there is almost no evidence for long-term impact. The perspectives are correspond to Qin et al. [21], Su et al. [22] and Quang et al. [30] that there are inadequate evidence to judge Bitcoin as safe-haven currency.

As investors generally have risk aversion, they pay more attention to long-term beneficial investment strategies, and are more risk averse under the economic fluctuation cycle. Therefore, the high volatility of Bitcoin in the short term of economic fluctuations suggests that Bitcoin shouldn't be chosen without caution in times of geopolitical conflicts and economic fluctuations. However, the VAR cumulative impulse function also presents a positive result, that is, Bitcoin may have a hedge value in the short term when the conflict just occurs. Therefore, for short-term speculators who are proficient in investment, Bitcoin may be a prudent choice in the period of geopolitical conflicts, but for most risk-averse investors, Bitcoin is not a good choice.

5. Conclusion

The study investigates the safe-haven value of Bitcoin during geopolitical conflicts. The Russia-Ukraine conflict is used as the representative of geopolitics, and takes the price of WTI and Brent crude oil as the medium of the Russia-Ukraine conflict influencing on the financial market, so as to

study the impact of geopolitics on the yield of Bitcoin, and analyze whether the safe-haven value of Bitcoin exists and stable under the background of economic fluctuations caused by geopolitics.

Through times series method, VAR and ARMA-GARCH, the paper finds that geopolitics has dual impacts on Bitcoin, with both the positive and the negative. Although the VAR accumulation model shows that geopolitics will have cumulative net positive impacts on Bitcoin's return rate in the short term, that is, Bitcoin can be used as a short-term safe-haven currency, more results show that the impact of geopolitics on Bitcoin is difficult to determine, and the long-term impact is close to zero. There is inadequate evidence that geopolitics will have a lasting impact on Bitcoin.

Therefore, for investors longing short-term speculation, Bitcoin may become a safe-haven currency, but for investors chasing long-term returns and having risk aversion, invest in Bitcoin as the period of geopolitical conflict still needs to be carefully considered.

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