

# The Russia-Ukraine conflict, crude oil prices, and electronic cryptocurrency market fluctuations

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**Abstract.** In the changing circumstances and the conflict between Russia and Ukraine, International crude oil prices rose sharply in the short term. This study will review the existing literature on the reason for the fluctuation of international crude oil prices and the dynamic change of Bitcoin, Tether, and Ethereum. This paper will also empirically evaluate the impact of fluctuation of international crude oil prices on the yield of electronic cryptocurrency. This research finds that the increase of futures crude oil prices will have a positive impact on the yield of electronic cryptocurrency, but this impact is short-term. Additionally, the growth of crude oil prices will not lead to the increase in the daily volatility of electronic cryptocurrency.

**Keywords:** The Russia-Ukraine Conflict, Crude Oil, Bitcoin, Tether, Ethereum.

## 1. Introduction

Nowadays, the change related to the international crude oil price and electronic cryptocurrency becomes increasingly prominent in the global financial market in recent years. Issues related to war, covid-19, and other uncertain events, bring huge uncertainty to the global finance market. During times of economic turmoil, there is a stronger link between oil and cryptocurrency. According to Okorie and Lin's paper, crude oil is one of the most important commodity markets in the world [1]. It seems to have a higher dependency between international crude oil prices and electronic cryptocurrency.

Crude oil is not only the world's largest traded commodity, but it is also the most essential energy resource in the finance activity. Oil prices' long-term trajectory is driven by supply and demand, which is accompanied by changing oil-related events [2-5] and rising speculation in crude oil financialized products [6-7]. At the same time, volatility in oil prices has been accentuated, and the oil market's unpredictability has risen. The frequency and magnitude of worldwide crude oil price changes have grown since 2004 [8-9]. The finance market promotes the fluctuation of crude oil prices through speculation and investment [10]. According to mounting evidence, oil price shocks carry considerable risk premia and powerfully signal economic concerns, and this phenomenon is becoming more important in the rapidly changing economic scenario. The volatility of crude oil prices is increasingly influenced by financial market fluctuations, such as the exchange rate of the US dollar, the stock market, gold, and the oil futures market [11].

As the oil price changed so rapidly over the night, Bitcoin (BTC) suffered a considerable loss, but it was not the only digital coin to suffer during this reign. Ethereum, Ripple, and bitcoin cash all suffered losses that were roughly twice as large. One of the study findings reveal that Bitcoin is influenced by both the crude oil price and the gold price, and that price rises in both factors generate an increase in Bitcoin prices, but some study only reflected the relationship at that time, it possibly be less accurate in the different point of time [12].

Financial stress and cryptocurrency conditional correlation have a positive but time-varying relationship, which develops quickly and drastically during financial market shocks [13]. So, this paper reflected that the recent international event will cause some financial stress, which will have a stronger relationship in cryptocurrency.

The gold market surpasses the crude oil and Bitcoin markets in terms of absorbing new information, but the Bitcoin market is subject to price movements in the gold and oil markets [14]. Cryptocurrencies are becoming more integrated and prominent over time, while cryptocurrency price

dynamics impact the price dynamics of energy commodities. Because Bitcoin and Litecoin are often at the center of return and volatility connectedness with other cryptocurrencies, information from these markets has a significant influence on other cryptocurrencies [15]. There are significant volatility spillovers between Bitcoin and other financial assets (gold and stocks), and an investment portfolio composed of gold, oil, Bitcoin, and equities can mitigate portfolio risk [16]. Therefore, it is important and valuable to focus on this topic, because the clear result of the relationship between crude oil price and electronic cryptocurrency can help investors do a wise decision.

Okorie and Lin used the VAR-MGARCH-BEKK methods and the Wald tests to evaluate the volatility connection between crude oil and ten cryptocurrencies [17]. Their experiment reflected that the relationship between cryptocurrency and oil price is negative. So there are some debates on this relationship, and this paper will prove that in more detail. Some studies have been conducted to examine the relationship between noble metals, cryptocurrencies, and crude oil. Omane and Adjepong observed a significant causal impact and proposed a big gap in volatility between exchange rates, gold, bitcoin, oil, and stocks [18]. Although there is a lot of research that reflected the relationship between the crude oil price and finance products, and some research also illustrated the correlation between Cryptocurrency and exchange rate, there is less research about international crude oil price impact on Cryptocurrency in recent days, so this topic will be investigated.

However, little research has examined oil market shocks as a key source of uncertainty in predicting Bitcoin volatility. Because there are fewer studies investigating this relationship in recent days, this research will fill this gap, and it will also be consistent with the previous study which indicates Cryptocurrency is possibly affected by the trend of crude oil price.

The following parts of the paper are organized below: the next section will include the data, research design, measurement, calculation, and statistical tests. Section 3 will contain the results of this model, and section 4 will include the discussion and evaluation of the results, which will also contain a comparison between this and the previous study. Section 5 is the conclusion.

## **2. Research design**

To analyse the main research question related to the relationship between electronic cryptocurrency and crude oil price, this paper established both the VAR-based model and GARCH model.

### **2.1 data resource**

This topic analyzes the effect between the earning rate of international crude oil price and electronic Bitcoin, Ethereum and Tether are several main electronic cryptocurrencies to research. This paper collects the daily price data of these several items from investing.com. The investing.com is a market app that gives real-time market quotes for over 100,000 different financial assets, including global equities, stock indexes, foreign currency, futures, bonds, and digital currencies, covering more than 70 nations and regions worldwide. In general, the data on this website is very reliable and, it is worthy to mention that the daily closing price is the original data that this paper used to conduct this research. Considering the effect of the conflict between Russia and Ukraine, this research focuses on the daily data between 2021.11.24- 2022.4.2. (Bitcoin, Ethereum, Tether, and Crude Oil price). There are some disadvantages to just focusing on these three themes in the long run. The data is a very important factor to make sure the accuracy of data-matching. Therefore, these three types of electronic cryptocurrency need to be analysed and make sure the data is more meaningful in this research.

### **2.2 unit root test**

To analyze these data, this paper took the log rate of return for this electronic cryptocurrency and used them as response variables in our modelling. To check if the daily return data of Bitcoin, Ethereum, Tether and Crude Oil price is stationary, this research use test of the unit root to check. This research needs to determine whether there is a unit root in the time series so the research can

take a further step in the research of relationships and trends, table one data shows the results of daily data.

**Table 1** ADF test

| Variables      | t-statistic | p-value   |
|----------------|-------------|-----------|
| Price          |             |           |
| Bitcoin        | -2.254      | 0.4597    |
| Ethereum       | -1.301      | 0.8876    |
| Tether         | -3.056      | 0.1170    |
| Crude oil      | -4.067      | 0.0071*** |
| Rate of return |             |           |
| Bitcoin        | -9.020      | 0.0000*** |
| Ethereum       | -8.675      | 0.0000*** |
| Tether         | -9.765      | 0.0000*** |
| Crude oil      | -6.909      | 0.0000*** |

According to the table 1, it is clear that all p-value of the rate of return is 0.0000, which is very significant, and so this paper can conclude that the Bitcoin, Ethereum, Tether and Crude Oil return rates are stationary, and reject the null hypothesis, which is the base of next step of the research.

### 2.3 VAR model specification

The VAR model describes each variable as a linear combination of its past values and the past values of other variables in the system. Because numerous time-series influence one another, it is considered as a system of equations with one equation for each variable (time series). This model is used in the multiple variables in the time series. Each variable is a linear function of its past lags and the past lags of the other variables. The past is a meaningful indicator of the future in this model. This model can distinguish the relationship between several variables and time series, and is used in risk management, finance management, financial report, and calculating the asset. The VAR model showed below.

$$\begin{pmatrix} y_1 \\ \vdots \\ y_k \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \vdots \\ \beta_{k0} \end{pmatrix} + \begin{pmatrix} \beta_{11} & \beta_{12} \\ \vdots & \vdots \\ \beta_{k1} & \beta_{k2} \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ \vdots \\ y_{k,t-1} \end{pmatrix} + \begin{pmatrix} \epsilon_1 \\ \vdots \\ \epsilon_k \end{pmatrix} \quad (1)$$

The impulse variable is the settlement price of international crude oil futures, and the response variables are bitcoin, Ethereum, and Tether currency yield respectively, and international crude oil futures settlement price as an exogenous variable.

### 2.4 GARCH model specification

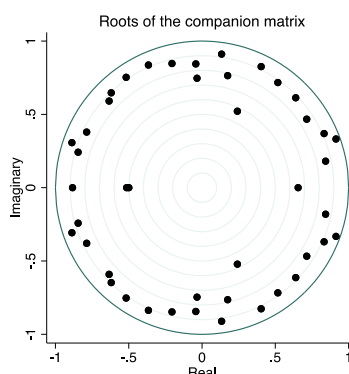
GARCH models explain financial markets in which volatility changes, becoming more volatile during financial crises or global events and less volatile during periods of relative quiet and stable economic development, and this model is very useful for analyzing and forecast volatility. The variance equation of GARCH model showed below.

$$u_t^2 = \delta_0 + \delta_1 u_{t-1}^2 - \delta_2 \varepsilon_{t-1} + \varepsilon_t \quad (2)$$

### 3. Empirical results and analysis

#### 3.1 VAR order identification and model stability

The larger the degree of freedom, the lesser the lag. The order is usually determined by the least AIC and SC criteria. If both the AIC and the SC reject the minimum value, the LR test is useful at that time. AIC and SC criteria should be used with care or confirmed by experience if the sample size of time series data is low. The model frequently lags behind the first, second, and third orders at this time, although producing outstanding results.



**Figure 1** VAR stability

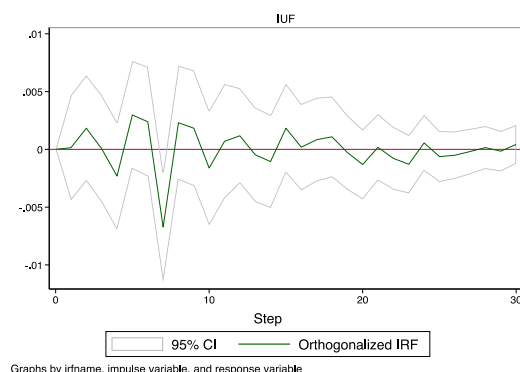
According to figure 1, all the eighteen values are inside this circle, which means the model is stable.

In this research, this paper used the rate of return of Bitcoin, Ethereum, and Tether to analyze the change in electronic cryptocurrency. According to table 2, I need to find the minimum value of each column, which is important for order determination. So, lag 11 will be chosen in this case, because of the relatively low p-value and it is the highest significance level in this case, because 0.020 is smaller than 0.05, which is the 95% significance level.

**Table 2** VAR identification

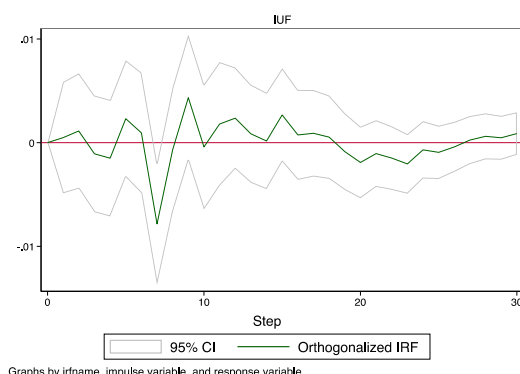
| Lag | LL      | LR     | df | p       | FPE     |
|-----|---------|--------|----|---------|---------|
| 1   | 1752.01 | 29.886 | 16 | 0.019** | 1.6e-18 |
| 2   | 1757.68 | 11.325 | 16 | 0.789   | 1.9e-18 |
| 3   | 1768.94 | 22.532 | 16 | 0.127   | 2.1e-18 |
| 4   | 1779.8  | 21.722 | 16 | 0.152   | 2.3e-18 |
| 5   | 1786.8  | 13.999 | 16 | 0.599   | 2.7e-18 |
| 6   | 1795.9  | 18.192 | 16 | 0.313   | 3.1e-18 |
| 7   | 1811.04 | 30.291 | 16 | 0.017** | 3.2e-18 |
| 8   | 1823.92 | 25.754 | 16 | 0.058   | 3.4e-18 |
| 9   | 1835.43 | 23.023 | 16 | 0.113   | 3.8e-18 |
| 10  | 1844.86 | 18.857 | 16 | 0.276   | 4.4e-18 |
| 11  | 1859.69 | 29.886 | 16 | 0.020** | 4.7e-18 |
| 12  | 1871.54 | 11.325 | 16 | 0.096   | 5.3e-18 |

### 3.2 Impulse response



**Figure 2** Impulse and response, Bitcoin

According to the figure 2, this paper can notice that the increase in the price of crude oil will lead to an increase in the rate of return in the price of bitcoin in a short period, and after that, there is a continuous fluctuation, this effect decreases gradually unit step 30.

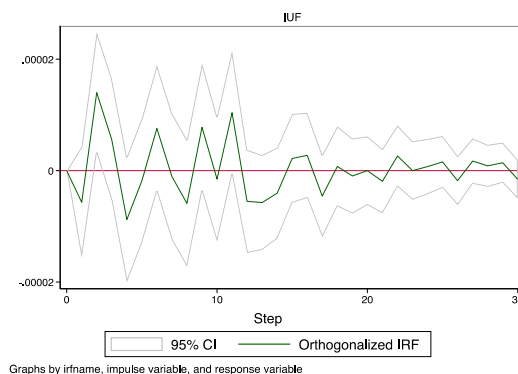


**Figure 3** Impulse and response, Ethereum

According to the figure 3, there is a short-term increase in the rate of return of Ethereum with the increase in the price of international crude oil price, and there is a sharp decrease near step 10, after that, there is a continuous fluctuation, but the majority of them are above 0, the final trend of rate of return of Ethereum is increasing slowly, and the fluctuation effect decreased gradually.

According to figure 4, the increase in the price of international crude oil price will lead to a decrease in the rate of return in Tether firstly, and there is a sharp fluctuation between 0 and 13 steps, and after that, the fluctuation gets much smaller until the step 30.

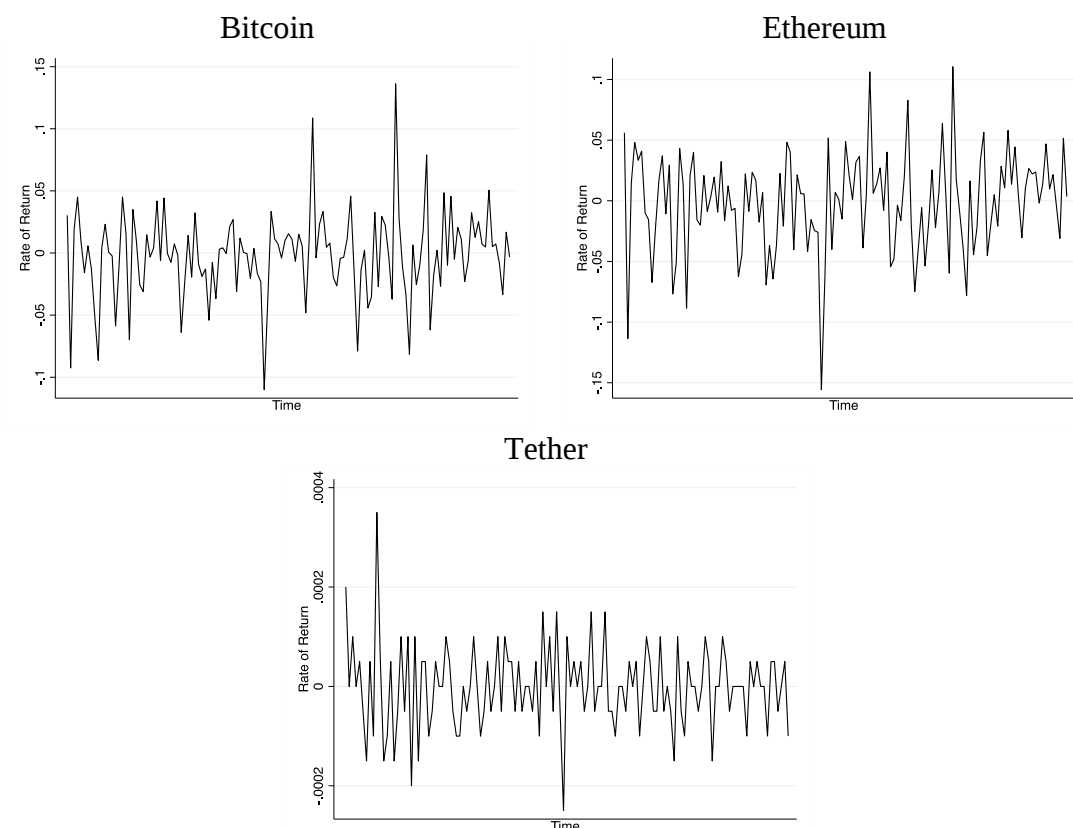
One possible reason to explain is that there is a Russian policy about change in the exporting of international crude oil, and Tether has a relationship with US dollars, which possibly causes some similar change in figure 4.



**Figure 4** Impulse and response, Tether

### 3.3 GARCH estimation results

According to the result of GARCH model estimation, the ARCH effect of Ethereum and Tether is not significant, which indicates that the rate of return of these two electronic cryptocurrencies doesn't have significant conditional heteroscedasticity. In terms of Bitcoin, the GARCH term is significant, which means this rate of return order has conditional heteroscedasticity. In the first column of the result, the estimated coefficient of return rate of crude oil is not significant, which expressed that the increase in the price of crude oil doesn't have a significant effect on the fluctuation of electronic cryptocurrency's daily volatility.



**Figure 5** Rate of return

**Table 3** GARCH model estimation results

| Variables  | Bitcoin                | Ethereum              | Tether                |
|------------|------------------------|-----------------------|-----------------------|
|            | (1)                    | (2)                   | (3)                   |
| Crude oil  | -0.9864<br>(0.6993)    | -4.597<br>(3.341)     | 2.046<br>(4.1103)     |
| ARCH (-1)  | -0.0449<br>(0.8333)    | 0.0068<br>(0.0743)    | -0.0360<br>(0.0947)   |
| GARCH (-1) | -0.8333***<br>(0.1491) | -0.3588<br>(0.6897)   | -0.3713<br>(1.194)    |
| Constant   | -6.113***<br>(0.1218)  | -6.109***<br>(0.5060) | -18.42***<br>(0.8316) |

## 4. Discussion

Firstly, by the comparison with the previous relevant studies, some article explores the linear and non-linear relationship between cryptocurrency return and oil price shocks, which have a similar aim to this research. However, the aiming circumstances and research methods are different, the researchers used the NARDL method and focus on the economic turbulence and covid pandemic. This article is focused on the period within the conflict between Ukraine and Russia.

This phenomenon might be caused by a variety of factors because the covid-19 and the conflict will cause the variance in the crude oil. With the severer pandemic development, and nervous conflict circumstances, the government possibly publish a much looser monetary policy, which leads to an increase in funds for private companies, and these funds possibly invest in the cryptocurrency market, people will find that cryptocurrencies investment will become more valuable.

This paper can also notice that there is a larger effect in the Tether and Ethereum, this is possibly due to some famous people also investing in these kinds of funds, which will promote their popularity of them [19]. The crude oil of Russia is in the third position in the world. The EU kicked out Russian banks from the global banking financial Telecommunications Association (Swift), which means that the Russian financial system is isolated from the global financial system. This probably leads to an increase in the price of crude oil, because of fewer financial connections.

The crude oil price during the conflict period also increased, which will lead to an increase in Ethereum and Bitcoin's return rate and a decrease in Tether's return rate in the short term. Therefore, short-term investors, probably need to choose the combination of these three funds, but they are recommended to invest in Bitcoin and Ethereum in the long-term investment. The policy deciders can choose to encourage investing the electronic cryptocurrency in the short-term, and avoid huge amounts of investment in electronic cryptocurrency in the long term, because of higher risk, and larger variance in the return.

The investors are deciding whether to join the investment in crude oil and electronic cryptocurrency. This article is an analysis of the relationship between these particular funds. The funding company can also get some insights from this article, change their directions and portfolios, and do some preventions for the uncertain risk and hedge that risk. The policymakers also can make some policies according to that trend. So this article is very valuable for people to take a reference the relationship between crude oil price and electronic cryptocurrency.

In the future, other researchers can take further steps in the research of some investment portfolios about crude oil futures and electronic cryptocurrency in the short term.

## 5. Conclusion

In general, our findings show that these results have similar findings to the past, which is the volatile relationship between crude oil spot prices and cryptocurrency. Additionally, the conflict between Russia and Ukraine will lead to an increase in the price of crude oil and will not cause a big

change in the return rate of the cryptocurrency market in the long term. According to the VAR-based impulse response analyses for two cryptocurrencies and the GARCH model, this paper can discover that the change in the crude oil's return rate will lead to a relevant change in the bitcoin and Tether's return rate in the short run, but this effect will be disappeared gradually in long run.

A further conclusion can be founded in these results, the price of crude oil futures can affect the electronic cryptocurrency's return rate a lot in the short run. While it is worth noticing that different exchange rates and different periods to invest will affect the outcome and profit. So some funding companies should vary their policies according to different immediate events and changing economic circumstances.

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