Fluctuations in Chevron's Share Price in the Context of the Russia-Ukraine War

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Abstract. The Russia-Ukraine war led to disruptions in the global energy supply chain and increased inflation. Western countries imposed sanctions to restrict Russian energy exports, triggering market shocks. This essay analyzes how the confrontation between Russia and Ukraine on February 24, 2022 may affect stock markets and energy markets throughout the world. The article selects the closing price of Chevron's stock from January 3, 2011 to July 28, 2023 as the raw data, and uses an ARIMA model to analyze the changes in Chevron's stock price and demonstrate the war between Russia and Ukraine's effects on it from multiple perspectives. It has been discovered that geopolitical developments may possess a significant short-term influence on stock values, but over time, the market gradually shifts its focus from a single event to a wider range of market factors, thus weakening the impact of geopolitical events on stock prices. This paper aims to fill the research gap on the stock price reactions of oil and gas companies in the face of conflict by analyzing the stock price changes of the energy company Chevron to show how global developments affect the American energy market, and to aid investors in evaluating the risks and possibilities, as well as to shed light on the market volatility and long- and short-term impacts of the energy sector. Finally, the paper provides investment recommendations that summarize the main points of the full paper.

Keywords: Russia-Ukraine conflict, Chevron, ARIMA model.

1. Introduction

The world changed forever on February 24, 2022, when Russian President Vladimir Putin delivered a nationally broadcast address declaring a "special military operation" against Ukraine, Russian troops loaded Ukrainian territory, Ukraine announced it had severed diplomatic ties with Russia, and the Russo-Ukrainian war started [1]. Conflict between Russia and Ukraine was started by Ukraine's insistence on joining NATO. The Russia-Ukraine conflict intensified tensions between eastern European countries and Russia, intensifying the confrontation between NATO and Russia. At the same time, a number of Western countries announced restrictions on Russian energy. A joint statement by the European Union, the United Kingdom, the United States, and Canada on February 26 announced a prohibition on select Russian banks utilizing the Society for Worldwide Interbank Financial Communications (SWIFT) system. This is the first major action of the West's economic sanctions against Russia, which will have a significant impact on the EU's imports of Russian oil and gas [2]. President Biden announced an executive order on March 8 that forbade the United States from purchasing any energy items, including coal, LNG, coal-related products, and some petroleum products, from Russia. Additional measures taken as part of this action included a ban on fresh investments in the Russian energy market and limitations on U.S. citizens and organizations' ability to fund and support Russian energy firms. Not only will the United States stop importing Russian energy, but it is also asking other countries to do the same [3]. On March 24, Biden was in Brussels to participate in the NATO special summit and other meetings, urging the European countries to increase sanctions on Russian energy. This series of policies has led to a reduction in Russian energy exports, which has had an impact on the world energy market [4]. The war and various types of sanctions will further disorganize the global supply chain, which is extremely fragile due to the epidemic, and greatly exacerbate the global inflation of the moment. Russia and Ukraine are major worldwide producers of agricultural and energy products. Russia is a significant supplier of natural gas to Europe and is the second-biggest producer of natural gas and the world's largest exporter of

natural gas, in addition to being the world's third-largest producer of oil and second-largest exporter of oil [5]. As a result of the harsh sanctions imposed on Russia by Western countries led by the U.S. on all fronts, as well as the short-term impasse in the Russian-Ukrainian conflict, the supply of commodities and necessities such as energy, building materials, and food has declined, leading to a continuous rise in prices. On the other side, the mutual closure of airspace between Russia and the United States as well as Europe has severely impeded international logistics. Some nations have been forced to slow down, even halt, or reverse their plans for economic recovery and capacity restoration as a result of sanctions, which have caused a prolonged rise in structural hazards to the global economy.

As a result of this tense political situation, stock markets around the world have suffered, particularly affecting the energy sector. According to a study by Boungou and Yatie, world stock market results are directly inversely correlated with the Russia-Ukraine war. The study, which selected 94 countries' stock returns as sample data during the Russia-Ukraine war, provides the first empirical evidence that stock markets are more affected during the two weeks of the war, but this effect gradually diminishes after three to four weeks [6]. Similarly, Qureshi and Rizwan et al. explore the systematic risk impact of different news events on Russia, Ukraine, Germany, France, Italy, the United States, the United Kingdom, and China through autoregressive moving average models. The empirical results indicate that, whereas China showed resistance to the sanctions, the ones placed on Russia caused systemic risk for the sampled European nations as well as the US. The empirical results indicate that, whereas China showed resistance to the sanctions, the ones placed on Russia caused systemic risk for the sampled European nations as well as the US [7].

However, the Russian-Ukrainian conflict does not always have an inverse correlation with the stock market and the performance of stocks in different sectors is not consistent. Ahmed et al. specifically examined the influence of this conflict in the European stock market and found that sectors such as energy, healthcare and industrials exhibited positive average abnormal returns, while sectors such as financials and non-essential consumer goods exhibited negative average abnormal returns. The study also found that small and mid-cap companies received a greater negative impact from the Russia-Ukraine conflict, while large-cap companies received a smaller impact [8]. The research by Kamal et al. examined the Australian stock market and reached similar conclusions. The conclusion states that companies in the consumer, industrial, real estate, and technology for communication and information sectors were adversely impacted on the day of the event, while companies in the energy and utilities sectors reacted positively to the stock market on the day of the incident, and companies with fast growth, illiquidity, and a focus on exports were particularly vulnerable to the crisis' consequences [9].

In addition, there is more concrete evidence that the energy sector demonstrated a positive reaction during the Russian-Ukrainian conflict. Using a sample of 1,630 energy companies from around the world, Nerlinger and Utz specifically examined how the Russian-Ukrainian conflict affected the stock prices of energy companies. The study found that before and after the event, these companies had positive cumulative average abnormal returns, meaning that energy companies outperformed the stock market. North American companies outperformed compared to European and Asian companies. And within a short period of time (within three days) of the event, the cumulative average return for the U.S. was positive, while the cumulative average abnormal return for the European firms was negative, which is consistent with the findings of Ahmed et al. in this Russia-Ukraine crisis: the effects on the European stock market article's findings [10].

Overall, the sectoral effects of the Russia-Ukraine war on a country's stock market have been the subject of significantly more studies, but there are fewer studies on how the stock prices of oil and gas companies react to changes in the Russia-Ukraine conflict. Therefore, this paper, hoping to do more to fill the research gap in this area, examines how the outbreak of the Russo-Ukrainian war affects the stock price of Chevron, a specific U.S. energy company, which is one of the largest energy companies in the world. The results of the analysis are significant in at least two ways. First, by examining how the Russo-Ukrainian conflict affected Chevron's stock price, an energy company,

helps us to understand how geopolitical events affect stock performance in the U.S. energy market. This helps investors, analysts, and policymakers to better assess risks and opportunities in order to develop more informed investment strategies. Second, such research can also shed light on the vulnerability of the energy sector and the volatility of the market, as well as the long- and short-term impact of geopolitical events on firm performance and investor sentiment.

The rest of the paper is organized as follows: the second part is the principle of the model used, including data sources, sample intervals and model introduction. This is followed by the third part, which focuses on the results of the ARIMA model and illustrates the influence of the war between the Russians and the Ukrainians on the price of Chevron shares from multiple perspectives, aided by certain data and pictures. After that, the fourth part discusses how investors should utilize the empirical results, giving advice to investors. Finally, a summary overview of the whole paper is given.

2. Methodology

2.1. ARIMA Model

In the 1970s, American statistician Jenkins and British statistician Box developed the ARIMA model, frequently referred to as the autoregressive moving average model [11]. The model's fundamental premise is to forecast the future using past data from the data itself. Labeled values at a point in time are affected both by labeled values over time and by chance events over time, which means that the ARIMA model assumes that: labeled values fluctuate around a general trend in time, where the trend is constituted by the influence of historical labels, the fluctuations are constituted by the influence of chance events over time, and that the general trend itself is not necessarily stable. There are three different types of ARIMA models: AR(p) for autoregressive mathematical models, MA(q) for sliding average mathematical models, and ARIMA (p, d, q) for autoregressive sliding average structures. The first two models are combined to form ARIMA (p ,d, q), in which the MA stands for moving average process, and q is the order of the moving average. AR stands for autoregressive process, and p refers to autoregressive order. What's more, the difference between stationary and non-stationary transitions is known as d. The ARIMA (p,d, q) mathematical model form can be expressed below:

$$\gamma_t = \mathrm{c} + \mu_1\gamma_{t-1} + \mu_2\gamma_{t-2} + \cdots + \mu_p\gamma_{t-p} + \theta_1\varepsilon_{t-1} + \theta_2\varepsilon_{t-2} + \cdots + \theta_q\varepsilon_{t-q} + \varepsilon_t \quad (1)$$

In this equation: γ_t is the time series data we are considering. μ_1 to μ_p are the parameters of the AR model, which are used to characterize the relationship between the current value and the value at the past p time points. θ_1 to θ_q are the parameters of the MA model, which are used to characterize the relationship between the current value and the error at the past q time points. ε_t is the error term at time point t. c is a constant term.

2.2. ARIMA Model Modeling Steps

The modeling of the ARIMA model consists of 4 steps: First, preprocessing the time series data, performing difference operations or other changes, completing the smoothing process, and testing the smoothness of the series through the unit root (ADF) test. Second, the model identification and determine the model order, can be based on the ACF and PACF charts to determine the model parameters p (autoregressive order), d (how many discrepancies must exist for the time series to be converted into a smooth one), q (sliding average order), based on the AIC criterion to select the optimal parameters to fit the model. If it is difficult to determine the order based on plots of the partial auto-correlation coefficient function and the auto-correlation coefficient function, then the difference is performed again to repeat step one. Third, diagnostic tests are performed on the model to determine if the residual series are white noise by performing a white noise test. If it does not pass the white noise test, the difference is performed again repeating step one. Fourth, the data are predicted and analyzed based on the model.

3. ARIMA Modeling and Analysis

3.1. Data Source and Sample Interval

The source data for this study, which has a total sample size of 3164 data, is the closing price of Chevron's stock from January 3, 2011, to July 28, 2023, as taken from the Wind database. The sample size basically covers the closing prices of Chevron on all trading days since 2011, and its weekly and monthly data are also counted. The unit root test is performed and the time series graph is plotted through Rstudio.

3.2. Parameter Selection of the Model

Due to the high volatility of the stock market, the stock time series is usually not smooth, and it is necessary to smoothen the original data to make the series become a smooth series and pass the smoothness test before the next step of model construction [12]. First, the time series samples are observed based on the time series charts and descriptive statistics characteristics of the stocks. As can be seen in Figure 1, Chevron's stock's closing price varies significantly over time, indicating that the initial series has to be smoothed using correlation processing. Therefore, the R software is used to process the first-order difference of the original data and then plot its time series, the results are shown in Figure 2, after the first-order difference, the time series shows a small fluctuation around the value of 0, so it can be preliminarily judged that the time series is a smooth sequence.

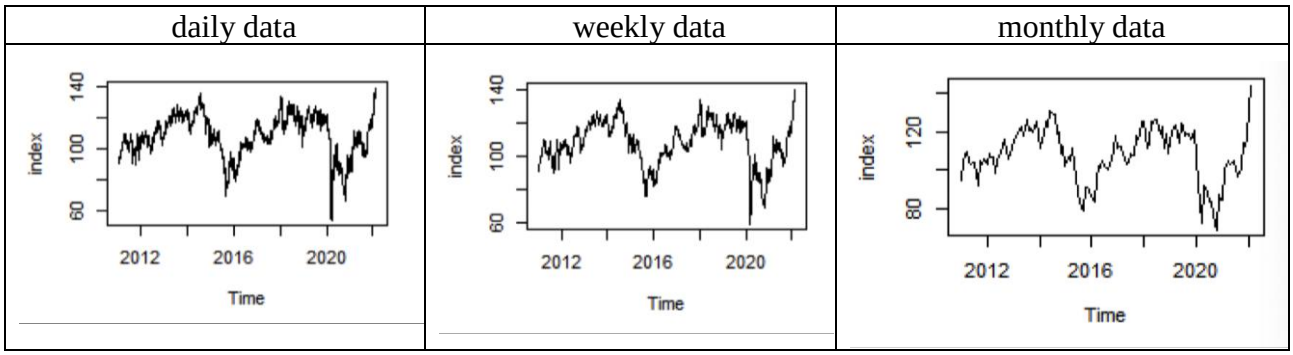


Fig.1 Raw Data timing chart

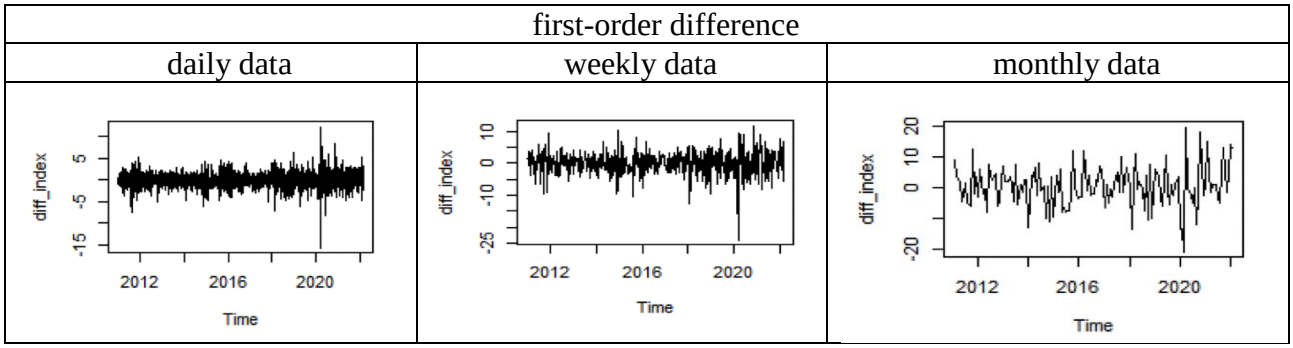


Fig. 2 Timing diagram of data after first-order differencing

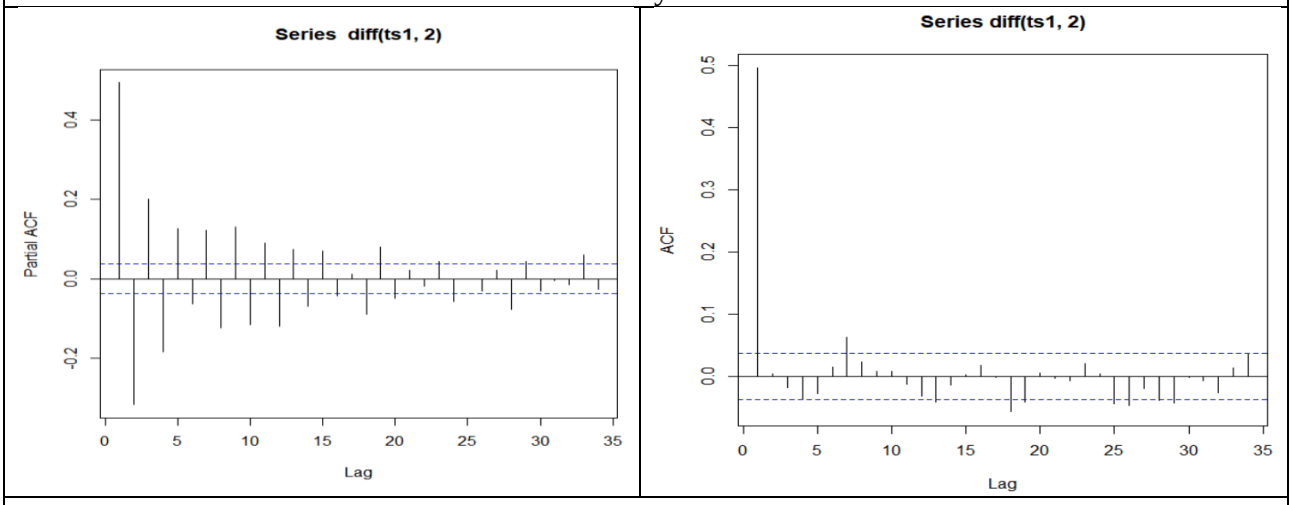
The smoothness of the sequence after the first-order difference is examined using the unit root test, Augmented Dickey-Fuller Test (ADF) is an expanded form of the DF test, which can be carried out on the existence of higher-order lags in the sequence of unit root test, the initial theory is that the sequence contains a unit root, which means that it is not smooth. Using adf.test() code in R language to carry out the unit root test, the test results show that the p-value is 0.01, rejecting the original hypothesis, indicating that the series is a smooth series, so the series after differential processing passes the smoothness test.

The first-order difference of the daily data is smoothed, but the values of p and q cannot be determined by plotting the ACF and PACF plots. Similarly, the first-order differencing of the weekly

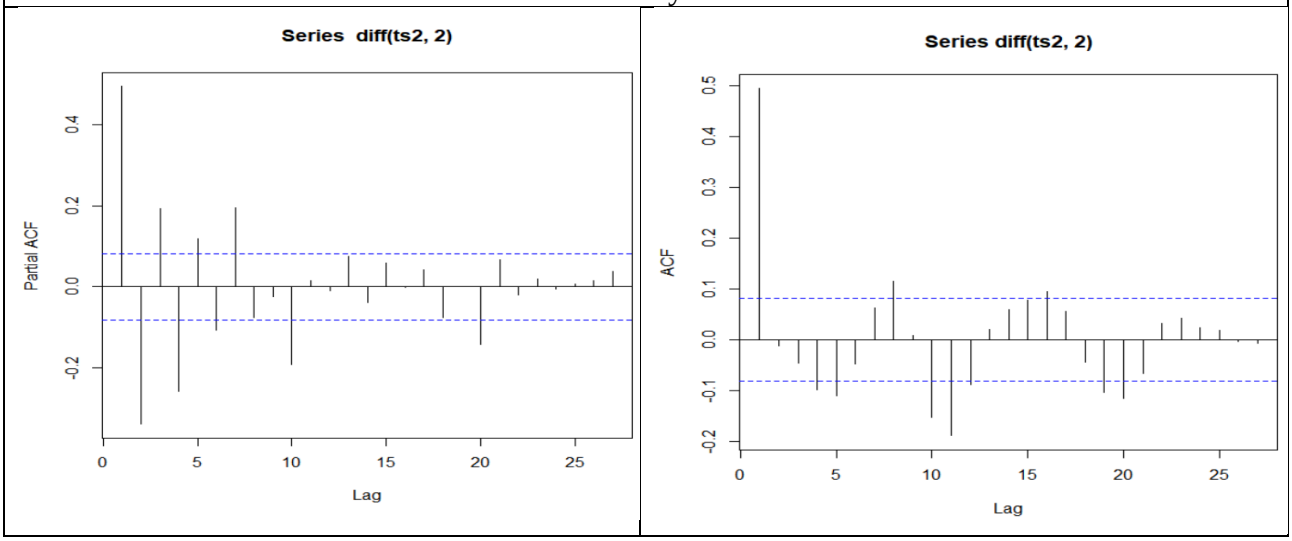
and monthly data was smooth, but the differenced data was white noise, and the PACF plot and ACF plot were not significant enough to extract useful information, so that the second-order differencing would have to be considered to make the autocorrelation or partial autocorrelation significant so that a model could be constructed to make predictions. So the series was continued to be second order differenced and after unit root test, the original hypothesis was rejected and it was concluded that there is no unit root and the series is smooth. After differentiating the original series into a smooth series, the ARIMA model was fitted. The autocorrelation and partial autocorrelation plots of the differenced time series are used to estimate the starting values of p and q, as shown in Figure 3. In order to ensure that the order selection is more accurate and appropriate, separate fitting calculations are performed for each of the various scenarios that can occur in the ARIMA using the automatic identification model function. As a result, the group with the smallest AIC value is selected. The AIC values corresponding to the models ARIMA(20, 2, 1), ARIMA(10, 2, 1) and ARIMA(4, 2, 1) are the ones with the smallest daily, weekly and monthly values, respectively.

The white noise test is passed after the estimated model has been obtained, and the results show that the residual sequence is essentially a white noise sequence. This indicates that the model has extracted nearly all of the relevant data from the sequence, making the three fitted ARIMA models mentioned above an ideal forecasting model.

Daily data



Weekly data



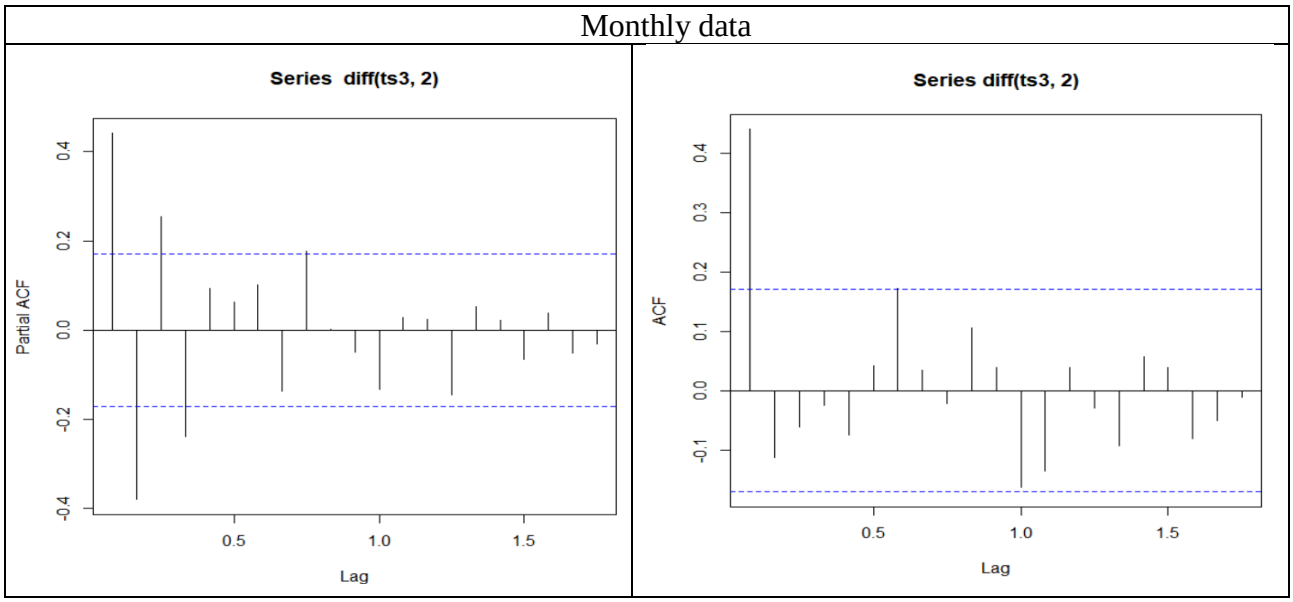


Fig. 3 PACF chart and ACF chart

3.3. Analysis of Empirical Results

According to the above test results, it can be seen that the ARIMA model fitting effect is more satisfactory, so the established ARIMA (20, 2, 1), ARIMA (10, 2, 1) and ARIMA (4, 2, 1) models can be used to predict the stock price, and this step is completed by using the forcast () code in R language. The stock price will be predicted for the following p trading days using the ARIMA model, which is ideal for forecasting in the short term and has high accuracy in this area. The forecasting results are displayed in Table 4, Table 5, and Table 6.

By predicting the stock price of Chevron when the Russian-Ukrainian conflict did not occur, this paper found that the Russian-Ukrainian conflict increased the stock price of Chevron by 17.38% in the next 20 days, 18.04% in the next 10 weeks, and 11.39% in the next 4 months' time. And in the 4th month, the impact of the war on Chevron's stock price decreases significantly.

Table 1. The results of forecast

	Daily data forecast	
	pred	se
2022/2/24	135.2919606	1.623842238
2022/2/25	135.5180086	2.240539109
2022/2/28	135.2631977	2.76702021
2022/3/1	134.9388988	3.18118504
2022/3/2	135.2704429	3.539018802
2022/3/3	134.9445693	3.858777906
2022/3/4	135.2025876	4.137946985
2022/3/7	135.1995491	4.454469372
2022/3/8	135.4298303	4.727882174
2022/3/9	135.4503944	5.001564898
2022/3/10	135.3360434	5.259491781
2022/3/11	135.3726125	5.502298377
2022/3/14	135.4552791	5.735069344
2022/3/15	135.5300354	5.937529222
2022/3/16	135.4399914	6.140640114
2022/3/17	135.5617833	6.329946285
2022/3/18	135.6444687	6.523396456
2022/3/21	135.5156947	6.714676126
2022/3/22	135.4344843	6.883462106
2022/3/23	135.5276152	7.039480696
	Weekly data forecast	
2022/2/26	140.2017709	3.476174377
2022/3/5	140.1044736	4.846218732
2022/3/12	139.0521466	5.957569163
2022/3/19	139.2264424	6.873441242
2022/3/26	139.8297924	7.619053507
2022/4/2	139.3754325	8.202794741
2022/4/9	138.7511826	8.707820559
2022/4/16	139.1556033	9.227382281
2022/4/23	139.8882581	9.823439884
2022/4/30	139.1037843	10.40228493
	Monthly data forecast	
2022/3/1	143.1771416	6.679317415
2022/4/1	142.5848064	9.31092564
2022/5/1	143.1371104	11.32298522
2022/6/1	144.6885956	12.7783167

This essay examines the effect of the Russia-Ukraine war on the price of Chevron shares from different perspectives. First, the start of the conflict between Russia and Ukraine paralyzed market participants, causing a short-term risk aversion effect that resulted in a 17.38% gain in just 20 days. Geopolitical events usually trigger uncertainty and risky sentiment in the market, causing investors to seek safe-haven assets. As an energy company, Chevron may be seen as a more stable investment option in the midst of geopolitical turmoil. As a result, investors may have been quick to put money into Chevron stock in the early stages of the Russia-Ukraine war, driving the stock price higher.

Second, the Russian-Ukrainian war has led to higher commodity prices and a positive long-term business outlook for Chevron. The energy sector tends to show relative resilience during geopolitical events because energy demand and supply are influenced by long-term trends in the global economy. Investors may believe that Chevron will be able to adapt to and capitalize on market volatility over

the long term and are therefore optimistic about the company's future business prospects. This optimism may cause the stock price to continue to rise over the next 10 weeks.

Finally, the market gradually absorbed the impact, rising 11.39% in the four months following the war. The market might eventually start to absorb how the company was affected by the Russia-Ukraine war over time. Investors may begin to consider factors such as the company's fundamentals, internal performance, and global energy market trends from a broader perspective than just geopolitical events. This market correction could lead to a gradual slowdown in share price gains. At month 4, the study found that the impact of war on stock prices diminished significantly. This may be due to the fact that investors are coming to realize that while geopolitical events may have an impact in the short term, a company's business fundamentals and market trends are more determinative in the long term. Factors such as a company's internal performance, capacity utilization, competitive dynamics, and macroeconomic trends may all influence stock price movements. Investors may gradually shift their attention from single events to broader market dynamics.

4. Discussion

Compared with existing studies, this paper focuses more on the performance of stock prices of leading companies in the energy sector in the Russian-Ukrainian war. Moreover, the paper selects three different statistics at the same time, conducts an empirical study and predicts the stock prices when there is no war. The short-term effects of the Russia-Ukraine war on numerous businesses are increasingly the focus of current publications. Chevron Corporation, an energy company, has sparked widespread investor interest in the context of the Russian-Ukrainian conflict with its volatile stock price. Based on the previous analysis, this article will analyze the company's investment outlook in detail from multiple perspectives and provide investors with comprehensive investment recommendations. For investors looking for short-term profits, consider investing in the early stages of the geopolitical outbreak. During this time, Chevron stock may rise quickly as investors seek safe-haven assets. However, it's important to note that this rise could happen relatively quickly, so you'll need to keep an eye on the market so you can sell the stock at the right time to avoid missing out on short-term profit opportunities. If one-person plan to hold the stock for the medium term, say 10 weeks to 4 months, you should focus more on the company's long-term business prospects. While geopolitical events may have an impact in the short term, it is the company's fundamentals and long-term strategy that will be the key determinants of the stock's long-term price movement. You need to have an in-depth understanding of the company's financials, industry position, and plans for future growth. In addition, pay attention to trends in the global energy market, as this can also affect Chevron's performance as an energy company. If one-person plan to hold Chevron stock for the long term, you should focus more on the company's sustainability and long-term strategy. Geopolitical events may trigger short-term volatility in the market, but long-term trends in the energy sector are more influenced by the global economy, energy demand and environmental factors. You need to have an in-depth understanding of the company's business model, technological innovations, environmental programs, and competition in the market. Make sure you have a clear idea of how the company is positioned for the future and consider how it will perform over the long term.

Investing always comes with risk. While Chevron has been a steady performer amidst geopolitical turmoil, the energy market itself is volatile. Investors should take care to diversify their investments and avoid excessive concentration of risk. In addition, market conditions and internal company factors can change at any time, and investors need to adjust their investment strategies in a timely manner.

5. Conclusion

The outbreak of a large-scale war between Russia and Ukraine has had a seriously impact on the global economy. Disruptions in energy supply will lead to higher energy prices, affecting global production and inflation. Disruptions in global supply chains will lead to stagnant production,

commodity shortages and higher prices. Trade disruptions would limit international trade flows, harming global exports and imports. Instability in financial markets could trigger investor panic, leading to volatility in stock and currency markets. Therefore, it is significant to investigate how the Russia-Ukraine conflict has affected energy company stock values. In this study, the stock closing prices of Chevron from January 3, 2011 to July 28, 2023 were selected and an ARIMA model was used to analyze the impact of the war between Ukraine and Russia on Chevron's stock returns. The results of this study suggest that geopolitical events can have a significant impact on stock prices in the short term, but over time, the market gradually shifts its focus from a single event to a broader set of market factors, which attenuates the impact of geopolitical events on stock prices. Moreover, this paper gives an opinion on Chevron investors based on the findings of the study in a number of ways.

This paper recognizes some potential limitations of this research. Although this paper delves into the diminishing impact of the outbreak of the Russo-Ukrainian war on Chevron after three months, the model can only make short-term predictions due to its limited predictions. This paper suggests that future research could investigate whether there are abnormal fluctuations in stock returns in the energy sector three months following the start of the Russian-Ukrainian war.

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