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The role of interest rate and inflation on oil stock prices: Evidence from Ukraine-Russia war

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Abstract

This paper presents an empirical investigation to study the effect of interest rate, inflation and gold price on stock price by considering the historical monthly prices from October, 2021, to October, 2022. The study also uses the prices of Exxon Mobil Corporation as the biggest oil producer in the United States for the same period. The study uses monthly 10-year Treasury-Yield, inflation and gold price for the same period. The study uses multiple linear regression and finds that two independent variables of inflation and interest rates influence oil price positively while gold price has no meaningful effect on oil price. In our survey, Interest rate is the most determinant of the price of Exxon Mobil share price ($\beta = 11.66$, $t= 9.22$) followed by Inflation ($\beta = 6.506$, $t= 15.69$) when the level of significance is one percent. The survey also investigates OPEC+ as well as the United States government actions during the study and finds minor influence on share price. The results indicate that any short-term interruption of oil price may lead to short to medium term on share price increase while the effect appears to have reverse effect on economy and slows down the world's economy and in longer periods causes oil price reduction.

Keywords: Interest rate, inflation, oil stock prices, Ukraine-Russia war

1-Introduction

Oil price plays an important role on world' economy (Zhou et al., 2023). An unexpected rise in oil price may also increase the other prices and ultimately lead to increased inflation. During the past few years, demand for oil was estimated to be about 100 million barrels per day while Russia alone produces about 10 million barrels per day. Therefore, Russia's oil supply plays an essential role on oil prices in the world. On February, 22, 2022, Russia officially started a war against Ukraine. Although there had been some conflict between two countries in the past, this time, Russia planned to start military operations from different regions. The European Union countries faced an unexpected action since they had planned to easily join Ukraine to NATO and this was not what Russia was interested in. Russia seemed to plan for an easy military operation and planned to use oil price as a tool to place pressure on western countries to reach her objectives. Oil normally maintains a relatively low elasticity of demand, which means that the demand for oil would not change substantially when the oil price changes. The supply of oil is relatively inelastic no matter how complex and expensive the process is to initially set up oil extraction (Johannesson & Clowes, 2022).

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A reduction in oil supply by Russia may create significant trouble on oil prices in the short term. Figure 1 shows the changes on oil price. As we can see from the figure, oil price maintained an increasing trend shown in green box in the figure in the short run, however, in longer period of time, oil price lost most of its gain in the short run. In other words, the government of the United States decided to release its strategic oil reserve to fight price increase. The members of the OPEC+, on the contrary, did their best to reduce the oil supply to keep the price higher. The other problem was that when the energy price increases, economy faces with an expected rise of inflation and this force the federal reserves of different banks to increase interest rate in an effort to cool down the economy. An increase in inflation and uncertainty may lead the economy to recession which would lead to decrease in oil demand in the world.

Fig. 1. Oil price

According to figure 1, oil price will decline after June 2022, and this slow trend is the result of weaker economic data which yielded to lower demand on oil. On March, 31, 2022, the government of the United States decided to release one million barrels of its strategic oil reserves to fight against any oil supply disruption. On October, 5th, 2022, OPEC+ members decided to reduce their production by 2 million barrels per day leaving their production to 42 million barrels per day.

2- Literature review

During the past few months, there have been tremendous efforts to study the effects of Russia-Ukraine on the world's economy (Kuzio, 2018; Behnassi & El Haiba, 2022). For instance, the Russia–Ukraine war has different negative socioeconomic effects (Rawtani et al., 2022) which are presently being well recognized and could worsen for global food security. When the Ukraine-Russia war deepened, the food crisis appeared more, resulting in a challenge to various countries, most importantly those relying on food imports. Ben Hassen and El Bilali (2022) performed a survey to show that the war could result in far-reaching cascading results on global food security. They reported that Ukrainian exports had been interrupted and population displacement created labor shortages, access to fertilizers was banned, and future harvests became uncertain. Orhan (2022) studied the effects of the Russia-Ukraine war on global trade. Yang et al. (2022) investigated the impacts of the information of monetary policy announcements on oil price. They determined that a positive central bank information shock, which raises the interest rate by six basis points could lead to a 1.7% increase in oil prices within two months. They also determined that central

bank information shocks could influence on oil prices through the finance and expectation channels. Shaeri and Katircioğlu (2018) performed an empirical investigation on the relationship between oil prices and stock prices of oil, technology and transportation firms under multiple regime shifts. They reported that crude oil prices and some other variables could be the long-run determinants of the stock prices of oil, technology and transportation firms. In their study, stock prices of oil companies were positively influenced by crude oil prices more than that of technology and transportation stocks. Razmi et al. (2016) performed an empirical investigation on the role of monetary transmission channels in transmitting oil price shocks to prices in ASEAN-4 countries between pre-global and post-global financial crisis.

Chortane and Pandey (2022) studied the effects of the Russia-Ukraine war on currency changes. Steffen and Patt (2022) tried to determine the tuning point on oil price during the Russia-Ukraine war. Sun and Zhang (2022) performed an analysis of global stock market reactions to the Russia-Ukraine war. The increase in oil price definitely increases the revenue of the oil companies and this could increase the share prices of the oil firms too (Abbassi et al., 2022). For instance, the price of the Exxon Mobil Corporation was doubled from mid-2021 to mid-2022.

2-1- Inflation

Higher oil prices have been an indicative for higher inflation (DeLong, 1997). During the 1970s, the increase in oil price resulted in higher prices and, at the same time, the signs of stagflation appeared. Oil price was about 3.35 per barrel in January 1970 and it reached 32.50 by the end of 1970. Just in a single day, on January 1, 1974, the Organization of Petroleum Exporting Countries (OPEC) raised the oil price by 135% reaching to a record high of 10.11 (Hammes & Wills, 2005).

Hunt (2006), for instance, performed a survey and reported that energy price shocks cannot generate the type of stagflation witnessed in the 1970s. According to Barsky and Kilian (2004), the rise in oil prices is believed to be responsible for any sort of recessions, inflation, which ultimately leads to reduced productivity and economic growth. Crude oil is considered to be a primary source of economic input, and when oil prices increase, we also expect an increase in inflation. Choi et al. (2018) studied the effect of changes in oil prices on inflation based on some data of 72 advanced and developing economies from 1970 to 2015. They reported that a 10% increase in global oil inflation may also lead to an increase in domestic inflation by approximately 0.4 percentage points on impact, with the impact fading after two years. They also reported that the impact was asymmetric, with positive oil price shocks may also lead to a larger impact than negative ones. The effect of oil price shocks, nevertheless, declined over time because of more credible monetary policy and less dependency on energy imports. They also investigated the transmission channels of oil price shocks on inflation by applying a monthly dataset over the period 2000-2015. Zhang and Hamori (2022) performed a connectedness analysis among BRICS's geopolitical risks and the US macroeconomy. They concluded that shocks from geopolitical risks could yield a considerable effect on emerging economies. Choi et al. (2018) suggested that the share of transport in the consumer price index (CPI) basket and energy subsidies were the most important parameters in describing cross-country variations in the impacts of oil price shocks during the period. Gómez-Loscos et al. (2012) reported that the transmission of oil price shocks to the economy was weaker than in the 1970s, which means that oil price shocks do not have their explanatory power as they did in 70s. Blanchard and Riggi (2013) performed a comprehensive overview on the reasons for different effects of oil price increase on the economy before and after the year 2000. LeBlanc and Chinn (2004) provided some more evidence on higher oil prices as primary sources of inflation. Haider (2018) studied the effect of interest rate, inflation rate, and exchange rate and gold prices on Karachi Meezan Index 30. Based on the recent literature review, we propose the following hypothesis,

H_1: A higher inflation has a positive impact on oil share price.

2-2- Interest rate

Many scholars have different perspectives on the relationship between interest rate and oil prices, nevertheless, the fact is that oil prices and interest rates seem to have some sort of correlation although this correlation may not be strong (Hooker, 1996). Several factors may influence the direction of both interest rates and oil prices. Naderi et al. (2019) presented some statistical forecasting models for crude oil price,

gas price, and interest rate based on meta-heuristic bat algorithm. Kim et al. (2017) investigated the effects of Oil price shocks on China's economy by looking into some reactions of the monetary policy to oil price shocks. Lorusso and Pieroni (2018) performed an investigation on the causes and consequences of oil price shocks on the United Kingdom economy. Ewing (2017) provided a more comprehensive survey on the effects of the oil price and interest rate on economy. Sotoudeh and Worthington (2015) investigated the effects of nonlinear interest rate of global oil price changes. Based on the recent literature review, we propose the following hypothesis,

H_2: A higher interest rate has a positive impact on oil company share price.

2-3- Gold price

Gold price has been considered as a hedge against uncertainty in the economy (Jones, & Sackley, 2016). When monetary policy increases the supply of money to the market in order to stimulate the market activities, gold price is expected to rise in price (Beckmann et al., 2019). On the other hand, when the inflation rate increases and monetary policy is ruled to reduce the money supply, gold price is expected to decrease in value. Based on the recent literature review, we propose the following hypothesis,

H_3: Gold price influences on oil company share price.

The proposed study of this paper uses Exxon Mobil Corporation as a case study. Exxon Mobil Corporation is dedicated for exploration operations as well as crude oil and natural gas production in the United States and internationally. The operations of the firm are through Upstream, Downstream, and Chemical segments. The firm is also involved in manufacturing, trading, transportation, and sales of oil production components such as, natural gas, petroleum products, etc. Table 1 shows the summary of the firm's revenue from 2013 to 2021. According to Annual report of the firm, Exxon Mobil Corporation has ownership of many international oil production companies including European countries.

Table 1. The summary of the firm's revenue from 2013 to 2021

Region	Revenue in 2013	Revenue in 2020	Revenue Share in 2020	Revenue Growth from 2013 to 2020
Australia	–	$5.83	4.71%	–
Belgium	$20.97	$6.23	5.02%	-70.29%
Canada	$35.92	$13.09	10.55%	-63.56%
France	$18.44	$8.67	6.99%	-52.98%
Germany	$15.70	–	0.00%	–
Italy	$19.27	$7.09	5.71%	-63.21%
Singapore	$15.62	$9.44	7.61%	-39.56%
U.S	$152.82	$62.66	50.50%	-59.00%
United Kingdom	$34.06	$11.05	8.91%	-67.56%

Reference: https://businessquant.com/exxon-mobil-revenue-by-region

As we can observe from the results of table 1, the firm supplies its products worldwide.

3- The proposed study

The proposed study of this paper uses the following linear models to measure the effects of different factors on share price of oil companies.

$$\text{Share Price} = \beta_1 \text{Interest rate} + \beta_2 \text{Inflation} + \beta_3 \text{Gold} + \varepsilon, \quad (1)$$

$$\text{Share Price} = \beta_1 \text{Interest rate} + \beta_2 \text{Inflation} + \varepsilon, \quad (2)$$

Where *Interest rate*, *Inflation* and *Gold* represent Interest rate, inflation and gold price, respectively. The study considers the date for before and after the war between Ukraine and Russia. Finally, Share Price represents the dependent variable. The study uses historical monthly prices of Exxon Mobil Corporation as the biggest oil producer in the United States for the dependent variable. The study also uses monthly 10-

year Treasury-Yield, inflation and gold price for three independent variables, respectively. All computations are executed in Minitab software. Table 2 presents the summary of the basic statistics used for this survey.

Table 2. Basic statistics of Share price, Inflation and 10-year Treasury-Yield

Time	Share price	Inflation	Treasury Yield	Gold Price
October, 2022	98.92917	8.1	3.87	1748.4
September, 2022	92.19476	8.202	3.51681	1635.9
August, 2022	93.49565	8.263	2.899304	1662.4
July, 2022	86.634	8.525	2.89175	1712.8
June, 2022	93.10905	9.06	3.140524	1762.9
May, 2022	90.36412	8.582	2.879529	1804.1
April, 2022	83.6575	8.259	2.74715	1909.3
March, 2022	80.71913	8.542	2.128609	1949.2
February, 2022	77.06105	7.871	1.937842	1899.4
January, 2022	69.169	7.48	1.7624	1795.0
December, 2021	59.41409	7	1.461864	1827.5
November, 2021	61.45095	6.8	1.556619	1773.6
October, 2021	61.26	6.222	1.593833	1783.0
Mean	80.57372864	7.915846154	2.491248762	1789.5

The proposed models presented in equation (1) and equation (2) have been widely used in the literature (e.g., Haider, 2018).

3- The results

The implementation of the multiple linear regression model has been used for two models. We first present the results for the first model given in equation (1). Table 3 presents the results

Table 3. The results of the regression analysis for model 1

Variable	**β**	**SE Coef**	**T-Value**	**P-Value**	**VIF**
Interest rate	12.01	1.84	6.54	0.000	35.09
Inflation	6.06	1.71	3.53	0.005	284.59
Gold	0.00152	0.00559	0.27	0.792	153.83

The results of table 3 indicate that the first two variables are statistically meaningful when the level of significance is one percent. However, the last variable, gold, is not meaningful when the level of significance is even ten percent. The price of gold appears to have no meaningful effect on oil share price. Therefore, the third hypothesis of the survey cannot be supported. We have also found little evidence on the relationship between gold price and oil stock price. Therefore, we consider the second model given in equation (1) and proceed with the results. Table 4 shows the results of the regression results for the second model given in equation (2).

Table 4. The results of the regression analysis

Variable	**β**	**SE Coef**	**T-Value**	**P-Value**	**VIF**
Interest rate	11.66	1.27	9.22	0.000	18.19
Inflation	6.506	0.415	15.69	0.000	18.19

As we can observe from the results of table 4, all coefficients are significant when the level of significance is one percent. The positive signs of both coefficients mean that an increase in both two independent variables may also increase the share price too. The biggest effect belongs to the presence of Interest rate followed by Inflation. In our study, Adjusted R-Square is equal to 99.88%, which means the independent

variables may describe approximately 99.87% of the changes of the dependent variable. Table 5 shows the summary of the ANOVA test.

Table 4. The summary of the ANOVA test

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	2	86579.2	43289.6	5571.16	0.000
Interest rate	1	660.2	660.2	84.96	0.000
Inflation	1	1914.1	1914.1	246.33	0.000
Error	11	85.5	7.8		
Total	13	86664.7			

The results of ANOVA test indicate that there is a linear relationship between the independent variables and dependent variable when the level of significance is one percent. Finally, Durbin-Watson Statistics is equal to 2.5620 which is within the desirable limit.

4- Discussion

One primary question is whether inflation is a cause of oil price increase, or it is an effect. Basically, there seem to be three measures which must be held to build a cause-effect relationship: The cause has to happen before the effect. Whenever the cause happens, the effect has to also happen. There should not be another component which can describe the relationship between the cause and effect. During the year of 2021, the presence of inflation seemed to appear prior to oil price increase and also an increase on the shares of Exxon Mobil Corporation. In fact, inflation was around 5% during the month of April, 2021. This gives some support for the results of this survey as the rise on inflation and interest rate are the cause of increase in stock prices.

5- Conclusion

In this paper, we have presented an empirical investigation to study the effects of some macro-economic factors on the price of oil and the shares of the oil producers during the turmoil of Ukraine-Russia events. The study used historical monthly information of the stock price, inflation, US 10-year treasury bond and gold price, and based on a regression analysis found that interest rate and inflation have maintained positive effects on stock price while gold price has had no meaningful effect on stock price. The results of this study are consistent with the findings reported by DeLong (1997) for the data in the 1970s. However, as stated by Gómez-Loscos et al. (2012), the effect may not necessarily lead the economy to a recession as it did in the 1970s. The presence of the war has appeared to have a short-term additional effect on oil price and heat the economy for higher gas prices and higher inflation. One strong sense that the economy may not face a big recession is that the economy is having the lowest interest rate ever during the past 50 years. In October, 2022, the rate of unemployment was around 3.7%. This rate was nearly unchanged during the years of 2022 and the low rate of jobless claims may be an indication that the economy is strong.

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