

The Russia-Ukraine Conflict, Crude Oil Price, and Transportation Industry Yield

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Abstract. The Russia-Ukraine Conflict had a serious impact on the economy of Russia and Ukraine and even the world, among which oil, banking, entertainment, and other industries were hit hard. Through the fluctuation of the transportation industry index during the Russia-Ukraine Conflict, this paper concluded that the Russia-Ukraine Conflict had a negative impact on the transportation industry in the short term. But in the longer term, the transport index soon leveled off. This paper finds that the global crude oil price index has a significant impact on the transportation industry only in the short term, and the fluctuation is particularly severe in the early stage of the outbreak of Conflict. This paper uses time-series model, VAR and ARMA-GARCH, to capture the impact of this external shock on the yield and volatility of transportation industry. Based on VAR estimation results, this paper finds that the VAR system we use is stationary processes. Further research finds that, through ARMA-GARCH model estimation, the change of international crude oil price will lead to the fluctuation of production of transportation industry. But this effect is delayed, which also reflects the time lag of financial market transmission. In this paper, we find that global crude oil prices have a significant impact on the inventory returns of the transportation industry in the short run. At the beginning of the conflict, returns were volatile, with the magnitude of the oscillations decreasing over time, and while the returns of the transport index were negatively affected by fluctuations in oil prices in the short term, the conflict had little impact on stock returns in the long term.

Keywords: The Russia-Ukraine Conflict; the transport industry; petroleum; energy price.

1. Introduction

As early as 2014, there were contradictions and disputes between Russia and Ukraine. On February 21, 2022, local time, Russian President Vladimir Putin announced the recognition of the "Donetsk People's Republic" and the "Luhansk People's Republic" and decided to carry out special military operations in the Donbass region on February 24, local time. The United States and NATO countries have taken economic sanctions against Russia and unilaterally provided a large amount of military aid to Ukraine.

Just one week into the conflict, the S&P 500 is down nearly 9 percent for the week, its worst weekly decline since June 2020. Russia's stock market came close to collapse: at one point it plunged more than 50 per cent in a single day and was forced to close for several days. Energy prices have soared. By March 4th, Brent crude in London and light crude in New York had topped \$118 and \$115 a barrel respectively. European gas prices have jumped 240% since the start of the year. Grain markets also saw a rare weekly gain. Wheat prices have risen more than 40 per cent in the past week to their highest level since 2006; Corn prices rose 14.72 percent to their highest level since 2013. Prices of metals and minerals also soared, especially aluminum, nickel and palladium. The price of palladium, a key metal used in catalytic converters for cars, has risen more than 60% this year, adding to the industry's continuing worse [1]. As of June 4, 2022, the Russia-Ukraine conflict situation is still anxious. Russia, in the face of western countries' economic sanctions, played the trump card of gas

energy tightening. Russia is Europe's biggest gas supplier, accounting for a third of its exports and nearly half of its imports. Europe is highly dependent on imports of crude oil, natural gas and coal, and any problems with natural gas supply will put European countries in a passive situation. As a result, Europe is heavily dependent on Russia for its oil and gas needs [2]. According to Fan, the sovereign credit ratings of Russia and Ukraine have also been affected by the special military operation. Standard & Poor's downgraded Ukraine's long-term credit rating to B- and Russia's to BB+ from BBB- [3]. China Credit International believes that the Russia-Ukraine Conflict is an unexpected and serious geopolitical event, which will have an all-round negative impact on Ukraine, causing an accelerated economic recession, a rise in financial burden, a sudden increase in external vulnerability risk, a rise in systemic risk, etc., and Ukraine's sovereign solvency is expected to be comprehensively damaged. As a result, China Credit International downgraded Ukraine's sovereign credit rating from Bg to CCCg and put it on watch for a possible downgrade.

Transport was the industry most affected during the Conflict with Russia, the world's largest energy exporter, and Ukraine, known as the breadbasket of Europe. But now, with the Conflict on its own soil, Ukraine's food production has fallen sharply. On March 22, Ukraine's Agriculture Minister Alexei Leshchenko said that only 7 million hectares of grain could be planted in the spring 2022 grain crop in the country, compared with 15 million hectares expected before the outbreak of the Ukraine crisis [4]. "The European Union is divided over whether to join the United States in imposing an oil embargo on Russia." European Union foreign ministers failed to reach an agreement on imposing an energy embargo on Russia at a meeting at the EU headquarters in Brussels, Belgium, Thursday, Reuters reported. International oil prices rose more than 7% on the day, returning to above \$110 a barrel. Us WTI for April delivery settled 7.09% higher at \$112.12 a barrel. Brent crude for May delivery was at \$116.68 a barrel, up 8.11% [5]. Russia's oil and gas is divided into Europe and Asia. Affected by the Conflict, the sales in Asia are in short supply while the energy storage in Europe will reach the upper limit. Therefore, Russia's energy and Ukraine's food are important to Europe and the world.

As a key means of payment, on February 27, 2022, the United States and Europe announced that some Russian banks would be excluded from the SWIFT payment system. This has put the international clearing business of Russia's local banks at risk. Turning to the airline industry, On February 28, 2022, Aeroflot suspended European flights. This would leave Russia over-reliant on land and sea transport and pipelines. At the international level, many countries began to embargo energy from Russia. US President Joe Biden announced Thursday that the United States is imposing an energy embargo on Imports of oil, gas and coal from Russia. But Russia, for its part, has also hit back at the economic sanctions imposed by the United States and The European Union in terms of currency settlement. "Ruble settlement order" came into effect, Russia formally sent a notice to the buyer. Russia has announced it will liquidate energy purchases in Russia by sanctioned countries in its currency, the rouble. Neighboring countries that did not participate in the Conflict were also affected to varying degrees. For example, the conflict between Russia and Ukraine has driven up food prices in Germany. The impact of Conflict is so profound that we need to grasp the stakes and examine the changes. Whatever the future holds, we will analyze the past as well as what has happened in the present. The world's energy transport landscape is still changing, and countries dependent on energy imports need to adapt as quickly as possible. The European Commission on Wednesday unveiled a 300-billion-euro investment plan to reduce dependence on Russian fossil fuels and speed up the transition to clean energy over the next few years.

Most academic studies have looked at the fluctuations of specific energy sources such as oil and gas affected by the Conflict during the Russia-Ukraine conflict, but few studies have looked specifically at how the entire industry was affected by the Conflict. For example, a study conducted in early May 2022 analyzed Russian oil exports to Europe [6]. This paper will analyze the changing situation of the transportation industry in the conflict between Russia and Ukraine. Based on the timeline of the Russia-Ukraine conflict, this paper studies the changes of the "transport index (CITIC)" with the Conflict and analyzes the policies behind it.

As the material basis for the survival and development of human society, energy plays an important strategic role in the national economy. Since the three energy crises broke out in the 1970s and 1990s, the impact of rising energy prices on the macroeconomic operation has gradually become a hot issue that economists pay attention to. In oil, for example, industry insiders estimate that the eu sanctions against Russia could lead to a supply gap of up to 4 million barrels per day, equivalent to 4.5-6.7% of global oil production in 2020. [7]. Energy, as a non-renewable resource, is an extremely important factor input in production activities and is closely related to the production activities of almost all products in the economy [8]. Energy shortage plays an increasingly prominent role in restricting economic development. How to improve energy utilization efficiency to promote China's economic structure transformation has become a topic of widespread concern. Scholars have done a lot of empirical research on energy price and energy intensity [9]. Energy is one of the most important commodities in the world today, and The Russia-Ukraine Conflict is bound to affect it. Furthermore, there are some existent models that help to evaluate the relationship of different elements in the financial world [10]. Thus, in this paper, the fluctuation of the transport industry index during The Russia-Ukraine Conflict will be explored.

The following parts of the paper are organized as follows: section 2 is the research analysis, which contains background and data, model specification, and introduction of identification strategy; Section 3 contains estimation results of the ARMAX, VAR, ARMAGARCH model. Section 4 is the discussion. Section 5 is the conclusion.

2. Research Design

2.1 Data Resources

In this paper the data about the transportation industry index and international oil futures price is downloaded from Wind-Financial Terminal. These data consist of the daily adjusted closed price that collected three months before and after the Russia-Ukraine conflict. Wind-Financial Terminal is a Chinese terminal that consist of the comprehensive and accurate market data. Which is a reliable website to gather the financial information such as the data has been used in this paper.

2.2 ADF-test

After gathering the data, the step that should be completed first is the stationarity tests for each variable. The equation for the ADF- test is as the follows:

$$x_t = c_t + \beta x_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t \quad (1)$$

By using this test from equation (1), we are able to check whether the series have a unit root, in another word, whether it is stationary. In this case, there will be a null hypothesis: $H_0: \beta = 1$ and an alternative hypothesis: $H_1: \beta < 1$. And for the decision for ADF-test will be select by looking at the p value.

Table 1. ADF test

Variables	t-statistic	p-value
	Price	
Transport	-2.714	0.2302
WTI	-2.961	0.1432
Brent	-2.942	0.1489
	Yield	
Transport	-8.589	0.0000***
WTI	-8.088	0.0000***
Brent	-7.936	0.0000***

As the information shown in table 1, the variables used for stationarity test is transport, WTI and Brent, and they are separated into Price and Yield. For the price part, the p-value is not significant which means that the data is not stable. For the yield part, the p-value is showing a 99% significance level.

In this case, the yield of transport, WTI, and brent will be use in the model because of the stationary of these variables.

2.3 Model setting for VAR

In order to test the how the changing price of oil will impact the transportation industry index return, this paper used a VAR model to test it. In this model, the variables will be connected together as a whole system and then predict it. The model is used as the follows:

$$y_t = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix} + \begin{pmatrix} \beta_{11} & \gamma_{11} \\ \beta_{21} & \gamma_{21} \end{pmatrix} y_{t-1} + \dots + \begin{pmatrix} \beta_{1p} & \gamma_{1p} \\ \beta_{2p} & \gamma_{2p} \end{pmatrix} y_{t-p} + \varepsilon_t \quad (2)$$

In the equation (2), we are assuming there are two time series and make $y_t = \{y_{1t}, y_{2t}\}$, and the ε_t in this equation is representing the residual.

Furthermore, in order to know how the change of one unit residual will impact other variables, there is a necessity to use the impulse response function shows as follows:

$$\frac{\partial y_{t+s}}{\partial \varepsilon_t} = \varphi_s \quad (3)$$

This equation (3) basically shows that when the error term increases by one unit in time t, the change of y_{t+s} at time t + s. At the same time other variables and error terms in different time remain the same value.

2.4 Model setting for ARMA-GARCH

The next step is to use the ARMA-GARCH model. This model is used to predict the future by using the volatility and rate of return of transportation industry index at the same time. As a result, the variables used in this model as exogenous variables are international oil futures. Moreover, with this model it will be clear to see the correlation between Russia-Ukraine conflict and the effect on the index.

The following is the ARMA (p, q) model:

$$x_t = \Phi_0 + \sum_{i=1}^p \Phi_i x_{t-i} + a_t - \sum_{i=1}^q \theta_i a_{t-i} \quad (4)$$

Basically, in equation (4) a_t is the sequence of the wight noise, and both p and q are non-negative integer. With this equation it will be possible to predict the future using past realized values and past disturbances. Furthermore, construct the GARCH (p,q) model will help to increase the accuracy of the prediction.

The following is the GARCH (p, q) model:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_q \varepsilon_{t-q}^2 + \gamma_1 \sigma_{t-1}^2 + \dots + \gamma_p \sigma_{t-p}^2 \quad (5)$$

In the equation (5), it can be separate in to two parts, one is ARCH part, another one is GARCH part: The ARCH part is $\alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_q \varepsilon_{t-q}^2$ and the GARCH part is $\gamma_1 \sigma_{t-1}^2 + \dots + \gamma_p \sigma_{t-p}^2$. GARCH model is taking ARCH model as the base and add σ_t^2 as the autoregression part.

Also, GARCH model is used to reduce the number of parameters and make the predicted future conditional variance be more accurate. More than that iteration can help ARCH(p) to be simplified to GARCH (1,1).

3. Empirical Results

3.1 VAR Order

According to table 2, Likelihood Ratio Test (LR) reaches its maximum value at lag=6. Therefore, we determine the lag order of the VAR model as 6. Before making prediction estimates for the parameters, it is necessary to ensure that the model we set is stable.

Table 2. VAR model identification

Lag	LL	LR	df	p
0	855.388			
1	862.622	14.469	9	0.107
2	868.028	10.812	9	0.289
3	869.560	3.0633	9	0.962
4	875.449	11.778	9	0.226
5	885.434	19.970	9	0.018
6	898.674	26.480*	9	0.002
7	905.445	13.542	9	0.140
8	909.055	7.2197	9	0.614
9	914.579	11.048	9	0.272
10	920.168	11.178	9	0.264
11	925.283	10.229	9	0.332
12	929.419	8.2730	9	0.507

VAR model stability test is shown in Figure 1. From the figure 1, we can find that all of the eigenvalues are inside the unit circle. Therefore, we can conclude that: VAR system that we use is stationary processes.

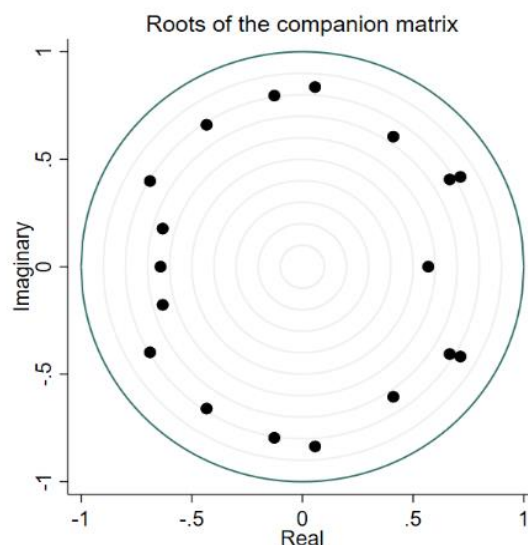


Figure 1. VAR stability

3.2 Impulse Response

We set the yield of WTI and Brent as impulse variables respectively and set the yield of transportation index as response variable. Then we build impulse response functions separately. We

set these two functions to research the impact of oil price fluctuations due to the Russian-Ukrainian conflict on the transportation industry. The evaluation results are drawn in the figure 2.

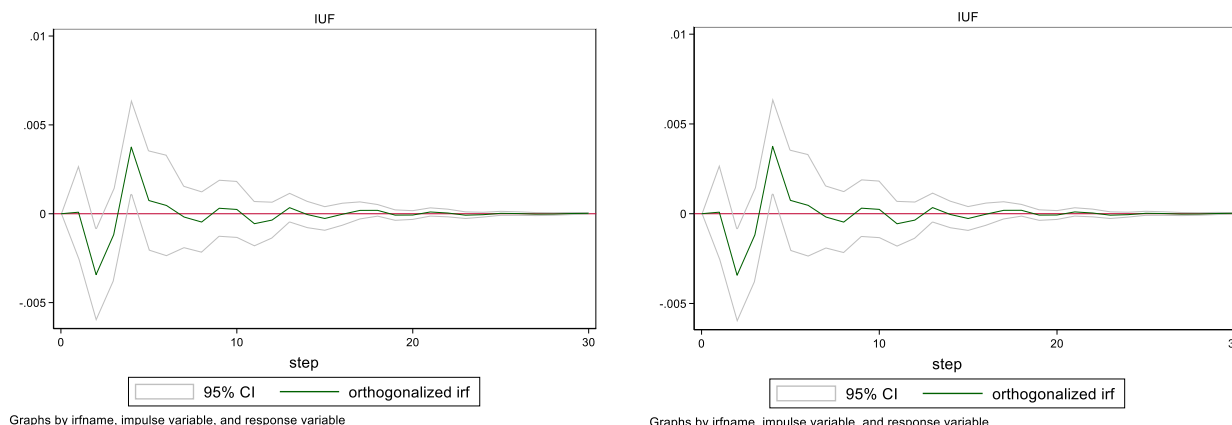


Figure 2. Impulse and response

Based on figure 2, we can find that the impact of international crude oil prices will cause short-term changes in transportation industry yields. In particular, the current increase in oil prices will significantly reduce the yield of the transportation industry in the next three periods. After three periods, the yield of transportation industry will turn to be positive. With time go by, the influence of the impact of current price will be decline and disappear gradually.

3.3 ARMA Order

First of all, we need to use PACF and ACF to determine the lag order of AR part and MA part respectively. The result is shown in figure 3.

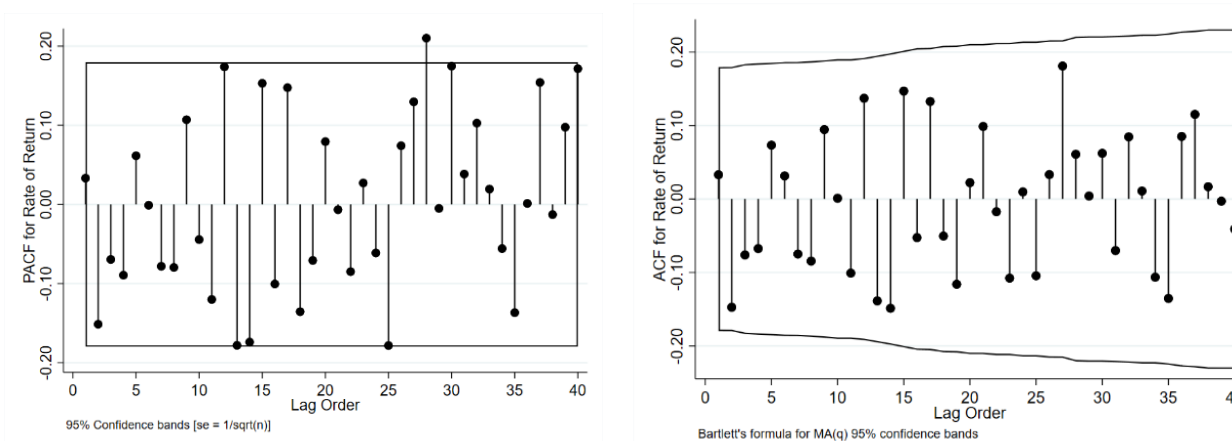


Figure 3. ARMA order identification, PACF and ACF

According to figure 3, in PACF, the autocorrelation coefficient at lag=28 falls outside the confidence region, this order's autocorrelation coefficient is significantly non-zero. Therefore, the lag order of AR model should equal to 28. In ACF, all autocorrelation coefficients fall within the confidence region, so, there is no order of AR model.

3.4 ARMA-GARCH Estimated Results

According to the above results, we use GARCH (1,1) and AR (28) model, without MA as there is no order of MA model. We put the yield series of the settlement price of international crude oil futures as an exogenous variable into the variance equation. The estimation result is shown in table 3.

Table 3. ARMA-GARCH estimation results

	(1)	(2)	(3)	(4)	(5)
WTI					
T=0	-10.5476*	-2.7013	-21.6329		
	(5.9099)	(5.4556)	(11.7027)		
T=-1		-11.1617**	42.53053**		
		(5.6135)	(18.4571)		
T=-2			11.5689		
			(16.7678)		
Brent					
T=0				-10.3398*	5.1670
				(5.8818)	(6.0909)
T=-1					-18.5097***
					(5.9239)
GARCH					
ARCH (-1)	0.0895	0.0484	-0.1081***	0.0870	0.0991
	(0.0782)	(0.0597)	(0.0257)	(0.0774)	(0.1010)
GARCH (-1)	0.4829	0.3430	0.9918***	0.5263	0.5016***
	(0.3334)	(0.5628)	(0.0178)	(0.3367)	(0.1844)
Constant	0.0009	0.0007	-0.0007	0.0008	0.0002
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0018)

According to table 3, based on the estimation results of the variance equation, we use the estimated results in column (3) to stabilize. We can find that changes in international crude oil prices will cause fluctuations in the yields of the transportation industry. But this effect is delayed, that is, when the price of crude oil increased in the period $t=-1$, the fluctuations of the yields in transportation area would occur in the period $t=0$. This reflects the time lag in the transmission of financial markets.

4. Discussion

Further research could work more on strategy investor on stock market could implement to reduce possible losses caused by the similar situation in the future.

The result of this research confirms that, since one of the major crude production countries is in conflict, the sanctions caused great fluctuations on oil price leads to the reduced return in transportation industry in short term. This is consistent with previous literature conclusions given by Ken Yang, suggesting a trillion of dollar change will cause the change 1.6 trillion change in sea transportation industry as well.

Crude oil and the by-product of it is the major cost of transportation industry. In the operation of international transportation corporate, the fuel cost is generally over 25% of total cost. Fuel cost is inevitable cost of transportation industry and only by transportation business can company effectively use its asset to generate revenue. Therefore, the growing price and fluctuated oil price is bound to seriously damage the operation of transportation industry.

Hence, it is necessary for the industry manager to find a way to maintain the current revenue while lowering the cost. It can be suggested that lower the transportation speed can be an efficient way to reduce the cost since the consumption of fuel is averagely the cubic relationship to the speed of vehicle. For the investor involved transportation industry, consider buying options is a reasonable way to hedging the loss and gain profit when the oil price occurs fluctuation, using the lagging of the time the risk conduct to financial market.

5. Conclusion

This article finds that the global crude oil price significantly affected the transportation industry stock return in short term. At the beginning of conflict, the rate of return fluctuated dramatically.

However, we can notice from the graph that the amplitude of oscillation decreased over time, to be specific, the negative influence on return will be reduced. After 3 days, the impact of oil price will decrease gradually and the remaining is not significant. In addition, the impact of oil price on financial market is time lagging, the fluctuation of transportation stock appears approximately 3 days after the changing oil price.

The conflict has had a significant influence on the globe economy. Transportation industry return were also hardly hit by the burst out of confliction.

This paper focuses on the impact of Russia-Ukraine conflict on the oil price which conduct to the return and volatility of transportation industry. We find that although the return of the transportation index is negatively affected by the oil price fluctuation in short term, there is little impact if conflict on the stock return in long run. The duration of the fluctuation conduct to financial market is about 3 days in generally.

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