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ABSTRACT

Petroleum and natural gas, which are among the most used energy sources in the world, have a significant impact on financial markets and macroeconomic indicators as they are used as raw materials in many fields. For this reason, Russia, Turkey, Brazil, and India, as energy importers and developing countries, may be affected positively or negatively by changes in energy prices. The main purpose of this research is to investigate the relationship between the exchange rates of Brent oil, crude oil (WTI), natural gas, the US dollar index, and the Russian ruble. In the study, weekly data between February 6, 2022, and December 25, 2022 were examined. A vector autoregressive model (VAR) was used to examine the relationship between the variables included in the analysis, and the direction of the relationship between the variables was determined by the Granger causality test. According to the results of the VAR model, the WTI price has a significant effect on the USD/RUB rate, but the USD/RUB rate does not have a significant effect on the Brent and crude oil prices. On the other hand, the results of the Granger causality test confirm the findings of the VAR analysis.

Keywords: Brent Oil, Crude Oil, Stock Market Index, Ruble, US Dollar Index
JEL Classifications: N70, Q43; C32; E5.

1. INTRODUCTION

Today, the development of technology and the increase in needs due to the increasing population increase the demand for energy. The limited availability of energy resources in nature makes them important for countries that use these resources as raw materials. Petroleum, which is the most used energy source, is an exhaustible resource and constitutes a large part of energy consumption in the world. Petroleum, which is used as a raw material in many fields such as asphalt, deodorant, carpet, shoes, aspirin, sunglasses, unbreakable glass, fertilizer, plastic, and shampoo, is also used as a fuel for transportation and heating. Oil, which is used in all areas of life, is important in financial markets as it can be bought and sold with the help of derivative instruments. Investors can create changes in oil prices by buying and selling oil with derivative instruments. All these factors can have an impact on companies that use oil as a raw material or trade in oil. The increase in oil prices may affect the stocks by increasing the input costs of the companies that use oil as a raw material. In addition, since oil is used as a fuel in transportation, it increases transportation costs, which reduces vehicle sales and fuel consumption.

In addition, investors who hope or expect to profit from oil price movements in derivatives markets may turn to stocks. Or, investors who think that oil prices will decrease after price increases can sell their stocks and take a short position in oil. The importance of natural gas, which is used as a raw material in various fields such as petroleum, is increasing due to the fact that it emits less carbon compared to other fossil fuels. In addition to heating, electricity generation, and transportation, natural gas is used in the production of various products such as steel, paper, and fertilizer. In addition, countries are making efforts to increase the use of electric vehicles. Therefore, the demand for electricity generation will increase, and a part of this electricity demand will be met by natural gas. Therefore, the demand for natural gas will increase, and this increase in demand may cause an increase in natural gas prices. The effect of energy prices on national economies and financial markets varies according to whether the country is an energy importer or exporter.

The study consists of five parts. In the first part of the study, the price movements of Brent oil and crude oil over time, the effects of these energy resources on the country's economy and financial markets, and their importance for Russia are mentioned. In addition, information was given about the causes of shocks in energy prices. In the second part of the study, academic studies on developed and developing countries, most of which are dependent on oil, are included. In the third chapter, the theoretical information about the data used and the analyses is given. In the fourth chapter, the findings obtained as a result of the analyses are given. In the last part, the results are interpreted and suggestions are made.

2. LITERATURE REVIEW

Shaharudin et al. (2009) examined the relationship between oil prices and stocks, stock market indices, interest rates, and industrial production in their study using VAR, VECM, variance decomposition, impulse response analysis, ARCH, and GJR-GARCH methods. The study was conducted for the USA, England, and India countries, and the 2003-2008 period was discussed. It has been revealed that there is a long-term relationship between oil prices and stocks, stock market indices, the interest rate, and industrial production. It has been found that oil prices in the USA have a positive effect on the stocks of oil companies, a negative effect in India, and differ according to the firm in the UK.

Kilian and Park (2009) examined the effect of oil price shocks on the US stock exchange in the 1973-2006 period using the structural VAR model. According to this study, it has been observed that oil supply shocks do not have a significant effect on stock returns, the increase in global demand for industrial goods increases oil prices and stock prices, and the increase in precautionary demand for oil causes oil prices to increase and stock prices to decrease.

Using the VAR model, Huang et al. (1996) examined the effect of energy prices on stocks and interest rates for the US country, and they discussed the period of 1979-1990 in their study. Accordingly, a causal relationship was found between future oil prices and oil companies, but no relationship was found between oil prices and the stock market index.

Acaravci et al. (2012) investigated the connection between Johansen and Juselius cointegration, Granger causality tests, and natural gas prices, stock market indices, and industrial output.In this study conducted for 15 European countries, the period 1990:1-2008:1 is discussed. According to the results of the analysis, a long-term equilibrium relationship was found between natural gas prices and industrial production and stock market indices in Austria, Denmark, Finland, Germany, and Luxembourg. Although there is a significant long-term relationship between natural gas prices and stock market indices, there is an indirect causal relationship between these two variables, according to the Granger causality test results. In addition, it was concluded that the increase in natural gas prices affected industrial production, and the increase in industrial production affected stock market index returns.

Ratti and Hasan (2013) examined the effects of oil price shocks on stocks and volatility in the returns of 10 sectors in the Australian stock market for the period 31 March 2000-31 December 2010 in Australia. In the study using the GARCH model, it was determined that the increase in the oil price return significantly affected the return of the index for the total market index, and the increase in the oil price volatility significantly reduced the volatility in the index.

Antonakakis and Filis (2013) examined the relationship between oil prices and stock markets between 1988 and 2011 for oil-importing countries (USA, UK, Germany) and oil-exporting countries (Canada, Norway) using the DCC-GARCH model. Accordingly, it was found that the time-varying correlation between the stock market index and oil prices is not stable, and this relationship differs depending on whether the country is an oil exporter or an importer. In addition, it has been concluded that demand-based oil shocks have a negative effect on stock market indices, while supply-based oil shocks have no effect on stock market indices. In addition, it was observed that oil price returns did not have a significant effect on the correlation between Canadian and Norwegian stock market indices. Chortareas and Noikokyris (2014) examined the relationship between oil shocks, stock prices, and dividend yield variables in the USA during the 1981-2006 period using the structural VAR model. In the study, a positive relationship was found between the change in oil prices and the dividend yield, and it was stated that the continuity of this relationship was due to the reason for the oil price increases.

Bastianin et al. (2017) examined the relationship between oil price shocks and stocks for the 1973-2015 period using structural VAR, impulse-response analysis, and variance decomposition methods. In this analysis for the G-7 countries, it is seen that stocks do not react to oil supply shocks, but demand shocks have a significant effect on stocks.

Papapetrou (2001) examined the effects of oil price shocks in the 1989-1999 period on Greek real stock prices, interest rates, industrial production, and employment. In this study, which used multivariate VAR, impulse-response analysis, and variance decomposition models, it was found that oil price shocks hurt industrial production and employment, while positive oil shocks hurt real stock returns. Maghyereh (2004), using VAR, variance decomposition, and impulse response analysis, examined the effect of oil shocks on stock returns in 22 developing countries. In this study, which covers the period of 1998-2004, oil shocks did not have a significant effect on stock market indices in developing countries, and it was determined that stock returns did not react rationally to shocks in the oil market. People have said that the effect of the oil price on a country's economy as a whole is bigger than it really is, especially for developing countries. Sarı and Soytaş (2006) examined the effects of oil prices in the years 1987:01-2004:03 on real stock prices, interest rates, and industrial production in Turkey using variance decomposition and impulse-response analysis. In the study, it was concluded that oil price shocks did not significantly affect real stock returns. The reason for this is envisaged as being the high rate of taxation on oil prices in Turkey and the reduction of the impact of shocks in world oil prices through changes in tax rates. As a result, this situation ignores oil price shocks to oil price levels and stock returns.

Celik and Cetin (2007) investigated the relationship between oil price shocks, GDP, bond/bill rate, CPI, current account deficit, and stock market index in Turkey using VAR, impulse-response analysis, and variance decomposition methods. In this study, which covers the 1997-2006 period, it is concluded that oil price shocks have effects on Turkey's macroeconomy and stock market. It has been found that oil shocks have the effect of increasing the CPI, the current account deficit, and the interest rate while reducing the GDP. At the same time, it was concluded that oil shocks increased the stock market index. Cong et al. (2008) examined the effects of oil price shocks on Chinese stock market indices based on the years 1996-2007. In the study, in which the multivariate VAR model was used, it was determined that oil price shocks did not affect production or stock returns except for some oil companies. But it was seen that the mining and petrochemical index went up when the volatility of oil prices went up.

Kapusuzoğlu (2011) tested the relationship between oil prices and the ISE National 100, ISE National 50, and ISE National 30 stock indices in Turkey between 2000 and 2010 with Johansen cointegration, Granger causality, and VECM models. As a result of the study, it was concluded that there is a long-term relationship between all stock market indices and oil prices. However, it has been concluded that there is a one-way causal relationship from all stock market indices to oil prices, but oil prices are not the cause of all three indices.

Fayyad and Daly (2011) examined the relationship between oil shocks and stock market returns and examined the Gulf Cooperation Countries (Kuwait, Oman, UAE, Bahrain, and Qatar), England, and the USA using VAR, variance decomposition, and impulse-response analysis. In the study, which covers the 2005-2010 period, it has been observed that oil shocks provide a significant cash flow in the Gulf Cooperation Countries (Kuwait, Oman, the UAE, Bahrain, and Qatar), but simultaneously cause current account deficits in the USA and England. Oil shocks have also been found to be explanatory for stock prices.

Eryiğit (2012), in his study based on Turkey, tested the effects of oil price shocks on the ISE 100, interest rates, and exchange rates using the cointegration test, VAR, impulse response analysis, and variance decomposition. Based on the results for the years 2005-2008, it can be said that oil price shocks explain a big part of the ISE and interest rates and have a bad effect on exchange rates.

Bolaman Avc (2015), using Johansen cointegration, Granger causality, and ECM, examined the relationship between oil prices and stock returns in Turkey in the 2003-2013 period. According to the results obtained from this study, a long-term unidirectional relationship was found between oil prices and stocks. However, it has been observed that there is a causality from oil prices to the stock market.

Yalçn (2015) tested the relationship of oil price shocks on the world real economic activity index, world oil production, and stock market indices by using the structural VAR model in his study on Russia, Kazakhstan, and Ukraine countries. According to the study covering the years 2000-2013, it has been observed that the change in the stock market is explained more by demand-based oil shocks compared to supply-based oil shocks. In addition, it was found that oil shocks were more effective after the 2008 crisis.

Yıldırım (2016) analysed the relationship between oil prices and Borsa Istanbul for the period 2003:1-2016:1 using Johansen cointegration, VECM, Granger causality, and impact-response analyses. In the study, it was observed that the increase in oil prices did not affect the BIST-100 index, but the decrease in oil prices increased the BIST-100 index in the long and short term. In addition, oil prices have an asymmetric effect on BIST-100. Examining the effect of oil prices on exchange rates, Zhang et al. (2008) analysed the effect of the US dollar exchange rate on international crude oil prices from the perspective of market transactions and found that there is a significant long-term cointegration relationship between the two markets; Zhou et al. (2021) stated that the inverse relationship between the US dollar index and oil prices is gradually weakening; and Wang et al. (2022) determined that fluctuations in oil prices are effective on exchange rate changes.

The study conducted by Acaravci et al. (2012) focuses on examining the long-term relationship between natural gas prices, industrial production, and stock prices in the EU-15 countries. The researchers employed the Johansen and Juselius cointegration test as well as error-correction based Granger causality models to analyze the data. Akbulaev and Rahimli (2020)contributed to the literature by conducting a statistical analysis of the relationship between oil prices and industry index prices. Akbulaev et al. (2022) conducted a study to examine the effect of energy prices on stock indices during the COVID-19 pandemic. The study focused on four emerging economies: Russia, Turkey, Brazil, and India. The study conducted by Antonakakis and Filis in 2013 explores the relationship between oil prices and stock market correlation, specifically focusing on five stock market indices from oil-importing (US, UK, and Germany) and oil-exporting economies (Canada and Norway) during the period of 1988-2011. The researchers employed the DCC-GARCH framework to analyze the data and draw conclusions. In the study of Avcı (2015), the effects of oil prices on the stock market, which is considered as the barometer of econometrics, were examined for the period of January 2003-December 2013. Çelik and Çetin (2007), Eryiğit, M. (2012), Jones et al. (2004) examined the macroeconomic effects of oil prices in their study. Sari and Soytas(2006), Yalçın (2015) and Suleymanli et al. (2020) examined the effect of oil prices on stock market indices and returns.

3. DATA SET AND ECONOMETRİC METHOD

3.1. Data Set

In this study, the relationship between Brent oil and crude oil (WTI) and important market indicators has been examined. The USD/RUB rate of these market indicators includes the US Dollar Index (in US dollars). In order to investigate the relationship between Brent petroleum and crude oil (WTI) prices and the USD/RUB rate, 46-week data for the period of 06.02.2022-25.12.2022, when large price fluctuations were observed in energy prices, was used. The vector autoregressive model was used to examine the relationship between the variables, and the direction of the relationship between the variables was determined by the Granger causality test. In this study, all analyses were carried out with the help of the EViews 12 package program.

3.2. Methodology

In this section, the methods used to choose the right model for investigating the relationship between the US dollar index, the USD/RUB rate, and Brent and crude oil prices are explained. An ordinary time series analysis may be appropriate if all the variables are stationary, but if they are not stationary, a cointegration analysis, a vector error correction model, or a vector autoregressive model may be the appropriate model to test this relationship. Therefore, this section begins with an explanation of stationarity tests. After the stationarity tests, the VAR model and the Granger causality test are explained.

3.3. Stability Tests

Stationarity is one of the most critical properties of time series data. It is possible to conclude the analysis with a "false regression" with a non-stationary series. On the other hand, having non-stationary data does not always mean that the relationship between these variables causes spurious regression. If the variables are cointegrated in their level form, the regression results will show their long-run equilibrium relationships.

There are several methods to test whether the variables meet the stationarity condition. One of the ways to test the stationarity of variables is unit root testing. The existence of a unit root is proof that it is not stationary. In this study, the Extended Dickey Fuller Unit Root Test obtained from the Dickey Fuller Test was used. The following 3 equations can be run in the traditional Dickey-Fuller test (Syzdykova and Azretbergenova, 2021:50):

$$\Delta y_t = \beta_1 * \gamma_{t\text{-}1} + \varepsilon_t$$

$$\Delta y_t = \beta_0 + \beta_1 * \gamma_{t\text{-}1} + \varepsilon_t$$

$$\Delta y_t = \beta_0 + \beta_1 * \gamma_{t\text{-}1} + \beta_2 * Trend + \varepsilon_t$$

In all three tests, the hypothesis is as follows:

H_0: $\beta_1 = 0$ The variable has a unit root, the variable is not stationary.

H_1: $\beta_1 < 0$ The variable has no unit root, the variable is stationary.

3.4. Vector Autoregressive Model

The possibility of endogeneity can bias traditional multilinear model estimates. At this point, the vector autoregressive (VAR) model is a suitable model designed to deal with internality problems. In the VAR model, all variables are considered internally, and their effects on each other are taken into account. In these models, an equation is created for each variable. In these equations, each variable becomes the dependent variable, and the lagged values of the dependent variable and the lagged values of the independent variables are added to the equation. In the end, there will be as many equations as there are variables. Thus, the effect of each variable on other variables can be tested. The VAR model will use the following systems of equations for the two variables (Syzdykova and Azretbergenova, 2021. p. 50):

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \beta i Y_{t\text{-}1} + \sum_{i=1}^{m} \beta i Xt\text{-}^1 + \varepsilon_t$$

$$X_t = \alpha_0 + \sum_{i=1}^{m} \beta i Y_{t\text{-}1} + \sum_{i=1}^{m} \beta i Xt\text{-}^1 + \varepsilon_t$$

VAR analysis requires determining the optimal lag length. In the above equations, it refers to the optimal delay. Depending on the information criteria, the appropriate lag length is selected. The information criteria used in this study are Likelihood Ratio (LR) statistics, Final Prediction Error (FPE), Hannan-Quenn (HQ), Schwarz (SIC), and Akaike (AIC). The lower the information criteria of the model, the more appropriate the lag length used in that model. However, information criteria alone are not sufficient to decide the optimal lag length. Serial correlation is a very critical problem in VAR analysis, as the VAR model includes the lagged value of the dependent variable. Therefore, before determining the optimal lag, model results with that lag should be tested for serial correlation. The appropriate lag length can only be chosen after it has been determined that the error terms are not serially related.

3.5. Granger Causality Test

The work of interest in regression analysis is the dependence of one variable on other variables. However, this does not always mean that there is causality between these variables. In other words, causality or the direction of the effect cannot be proved by the existence of a relationship between the variables (Gujarati, 2013. p. 652).

Table 1: Descriptive statistics

Meaning	LNBRENT	LNDEX	LNRUB	LNWTI	LNNG
Mean	−0.002058	0.001570	−0.002157	−0.003169	0.002762
Median	0.001213	0.004564	0.000371	0.002386	0.003050
Maximum	0.187363	0.028974	0.235332	0.233506	0.167942
Minimum	−0.147537	−0.042507	−0.134127	−0.137477	−0.263341
SD	0.064846	0.012488	0.065660	0.068794	0.108421
Skewness	0.103275	−0.618060	0.910385	0.752440	−0.666818
Kurtosis	3.778727	4.989806	5.271339	4.875318	2.998954
Jarque-Bera	1.244067	10.51736	16.24219	11.08117	3.408956
Probability	0.536852	0.005202	0.000297	0.003924	0.181867
Sum	−0.094664	0.072229	−0.099211	−0.145790	0.127072
Sum square deviation	0.189227	0.007018	0.194008	0.212970	0.528977
Observations	46	46	46	46	46

SD: Standard deviation

The Granger causality test consists of estimating the following regression systems (Syzdykova and Azretbergenova, 2021. p. 51):

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \beta i Y_{t-1} + \sum_{i=1}^{m} \alpha i X t\text{-}^{1} + \varepsilon_t$$

$$X_t = \alpha_0 + \sum_{i=1}^{m} \gamma i Y_{t-1} + \sum_{i=1}^{m} \delta i X t\text{-}^{1} + \varepsilon_t$$

Using these models, the Granger causality test reveals not only the significance of the relationship between variables but also the direction of the relationship between these variables.

Table 2: Correlation matrix

Variables	LNBRENT	LNDEX	LNRUB	LNWTI	LNNG
LNBRENT	1				
LNDEX	−0.0411	1			
LNRUB	0.4571	0.0265	1		
LNWTI	0.9498	0.0323	0.4488	1	
LNNG	0.2121	0.1439	0,0036	0.21347	1

4. EMPIRICAL RESULTS

In order to determine whether there is a multicollinearity problem between the variables used in the study, first of all, the correlation relationship between the variables is investigated (Table 1). Table 2 below shows the correlation matrix between independent variables.

The bilateral correlation between the variables confirms that there is no multicollinearity in the model because the correlation between the independent variables is not greater than 90%. In other words, it is seen that there is a negative and weak relationship of -0.0411 between Brent oil and the US Dollar Index and a positive and weak relationship of 0.0265 between the US Dollar Index and USD/RUB. It is seen that there is a moderate relationship between USD/RUB and Brent and crude oil prices in the positive direction of 45.71% and 44.88%. There is a positive correlation at a level of 0.9498 only between the two Brents and crude oil.

4.1. Unit Root Tests

Since the data used in the study are time series, unit root status should be examined. For this purpose, the Extended Dickey-Fuller

Table 3: Augmented Dickey-Fuller unit root test results

Variables	Intercept		Trend and intercept		None		Unit root
	T	P	T	P	T	P	
LNBRENT	−8.5164	0.0000	−8.7147	0.0000	−8.5134	0.0000	No
LNWTI	−8.3263	0.0000	−8.4381	0.0000	−8.3203	0.0000	No
LNDEX	−6.1791	0.0000	−6.8473	0.0000	−6.1811	0.0000	No
LNRUB	−5.0090	0.0002	−4.9798	0.0011	−5.0609	0.0000	No
LNNG	−5.863278	0.0000	−6.312354	0.0000	−5.940580	0.0000	No

Table 4: Information criteria for selection of lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	380.0965	NA*	7.78e-15*	−18.29739*	−18.08842*	−18.22129*
1	390.2299	17.30091	1.62e-14	−17.57219	−16.31836	−17.11561
2	411.7343	31.46984	2.04e-14	−17.40167	−15.10298	−16.56461
3	431.2780	23.83376	3.09e-14	−17.13551	−13.79195	−15.91797
4	453.9505	22.11956	4.76e-14	−17.02198	−12.63356	−15.42396
5	498.3667	32.49965	3.39e-14	−17.96911	−12.53583	−15.99061

AIC: Akaike information criterion, HQ: Hannan-Quinn, FPE: Final prediction error, LR: Likelihood ratio, NA: Not available, * indicates lag order selected by the criterion

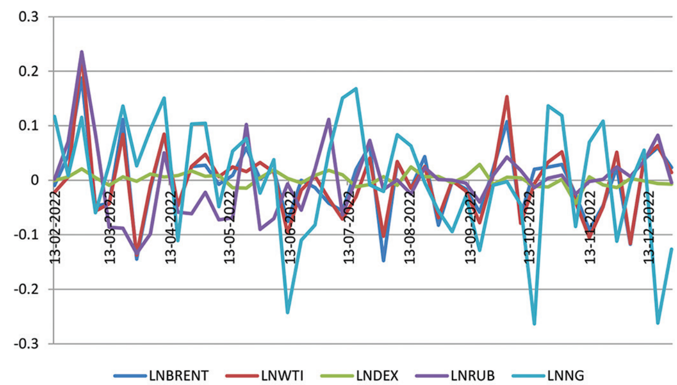
Table 5: The cointegration rank test

Unrestricted cointegration rank test (trace)				Probability**
Hypothesized		Trace	0.05	
Number of CE (s)	Eigen value	Statistic	Critical value	
None*	0.622103	115.1126	69.81889	0.0000
At most 1*	0.463416	72.29471	47.85613	0.0001
At most 2*	0.365908	44.90329	29.79707	0.0005
At most 3*	0.300645	24.85859	15.49471	0.0015
At most 4*	0.187282	9.124355	3.841466	0.0025
Unrestricted cointegration rank test (maximum eigen value)				**Probability****
Hypothesized		**Maximum-Eigen**	**0.05**	
Number of CE (s)	**Eigen value**	**Statistic**	**Critical value**	
None*	0.622103	42.81790	33.87687	0.0033
At most 1	0.463416	27.39141	27.58434	0.0529
At most 2	0.365908	20.04470	21.13162	0.0704
At most 3*	0.300645	15.73424	14.26460	0.0291
At most 4*	0.187282	9.124355	3.841466	0.0025

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level, *denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

(ADF) test was used. Table 3 presents the ADF unit root test results applied to the variables. According to these results, the ADF test shows that all variables are stationary at a level of 95%. When the stationarity properties of the other variables are tested at the first difference, the 0 hypothesis is accepted.

From the applied unit root test results, it is seen that the variables included in the analysis consist of both stationary and non-stationary data. The first condition for searching for cointegration among variables is that all variables have the same order of integration. Therefore, there is no cointegration relationship between the variables of Brent oil price, US dollar index, USD/RUB rate, natural gas price, and crude oil price. By stating that the variables do not have any cointegration vectors, one of the ways to investigate the relationship between these variables is to make the non-stationary variables stationary. All variables included in the analysis are stationary.



4.2. The Results of the VAR Model

4.2.1. Delay length selection

The first step in running the VAR model is to determine the appropriate lag length. In the Table 4, the lag length is determined according to different models.

The information criterion statistics show that the appropriate lag length is 0 because 4 out of 5 information criteria selected the model with lag 4 as the appropriate model.

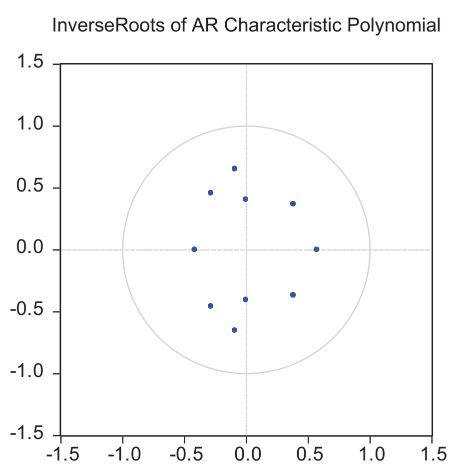


Table 6: Results of the granger causality test

Null hypothesis	F-statistic	Probability
LNDEX→LNBRENT	0.88069	0.4226
LNBRENT→LNDEX	0.48960	0.6166
LNNG→LNBRENT	0.11919	0.8880
LNBRENT→LNNG	1.55774	0.2234
LNRUB→LNBRENT	0.31949	0.7284
LNBRENT→LNRUB	2.28310	0.1154
LNWTI→LNBRENT	0.32543	0.7242
LNBRENT→LNWTI	0.38877	0.6805
LNNG→LNDEX	0.38345	0.6840
LNDEX→LNNG	0.36461	0.6968
LNRUB→LNDEX	0.36696	0.6952
LNDEX→LNRUB	0.00729	0.9927
LNWTI→LNDEX	0.59930	0.5542
LNDEX→LNWTI	0.65386	0.5256
LNRUB→LNNG	2.44010	0.1004
LNNG→LNRUB	0.59500	0.5565
LNWTI→LNNG	1.60808	0.2133
LNNG→LNWTI	0.08169	0.9217
LNWTI→LNRUB	3.04212	0.0592
LNRUB→LNWTI	0.22724	0.7978

4.2.2. VAR model estimates

The regression results of the 2-delay VAR model are as follows. Statistics in parentheses are statistics, and statistics in parentheses are standard estimation errors. t-statistics are calculated by dividing the coefficient by the standard error of the coefficient (Table 5).

4.3. The Granger Causality Test

The Granger causality test determines the direction of influence between the variables. Granger causation can be commented on. Using the Granger Causality test, the results about the direction of the relationship are given in the Table 6.

According to the Granger causality test results, it was determined that WTI crude oil was the Granger cause of USD/RUB. The p-value of the test statistics for WTI is 0.0592, which is less than the 10% significance level. Therefore, the null hypothesis that it does not cause the WTI price is rejected. Similarly, the p-value of the crude oil price is less than 10%. Therefore, the WTI crude oil price is the principal cause of the USD/RUB exchange rate at a 90% confidence level. On the other hand, Brent oil and natural gas prices are not the primary causes of the USD/RUB exchange rate and the US Dollar index. In this case, it can be said that the Granger relationship between the WTI price and the USD/RUB rate is not bilateral. As a result, it can be said that the results of the Granger Causality Test confirm the findings of the VAR analysis. Both methods show that, apart from the crude oil price, Brent oil and natural gas prices do not have a significant effect on the USD/RUB exchange rate. However, in terms of the effect of the USD/RUB exchange rate on the natural gas price, it opened the 10% significance limit with a very small 0.1004. In this case, it would be worth noting that the USD/RUB rate has a slight influence on the natural gas price.

5. CONCLUSION

The relationship between financial assets is very important for investors as it can influence their diversification decisions. This research examines the relationship between the USD/RUB exchange rate and the US Dollar index and the prices of Brent oil, crude oil, and natural gas relationship between the USD/RUB exchange rate and the US Dollar index and the prices of Brent oil, crude oil, and natural gas. In order to investigate the relationship between energy prices, the USD/RUB exchange rate, and the US Dollar index, a vector autoregressive model was used with 46-week data for the 2022-February 2022-December period, and the direction of the relationship between variables was determined by the Granger causality test. According to the results of the VAR model, crude oil prices have a significant effect on the USD/RUB exchange rate, but the USD/RUB exchange rate has no significant effect on the Brent and crude oil prices. The VAR results show that an increase in the current crude oil price will increase the USD/RUB exchange rate within 2 weeks. However, the oil price coefficient is very small, making it a negligible rate. On the other hand, the results of the Granger causality test confirm the findings of the VAR analysis.

The result of this study shows that USD/RUB investors should follow crude oil price changes carefully. Although the results provide some valuable information regarding the relationship between USD/RUB, crude oil, and WTI prices, it may be useful to analyze other periods and compare the results with the findings in this study. An extended analysis will help us see whether these results are specific to the periods used or if they can be generalized. In addition, investors should not forget that the dynamics in financial markets may change, even if the findings of this study are generalized, as financial markets are affected by many factors.

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