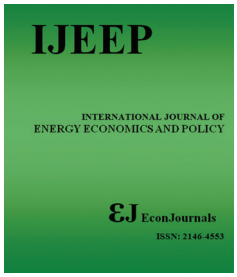

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Empirical Analysis of the Relationship between Basic Energy Sources and the Tourism Sector Index

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ABSTRACT

In the study, the short-term causality relationship between oil and natural gas prices, which are the main energy sources, and the XTRZM index was analysed with the Granger causality test. The DCC-GARCH model was used. Analyses were carried out over the monthly closing values between January 02, 1997 and December 01, 2022. According to the Granger causality test findings, the reason for both Brent oil and Crude Oil WTI in the XTRZM index is that Brent oil is the cause of Crude Oil WTI. It has been concluded that natural gas, Brent oil, and crude oil are not the causes of the XTRZM index and each other. Because Brent oil and crude oil are not included in the WTI XTRZM index, it has been determined that there is unidirectional Granger causality from the XTRZM index to Brent oil and crude oil WTI. According to the findings obtained from the DCC-GARCH model, there is a positive correlation between natural gas, Brent oil, crude oil, and the BIST tourism index.

Keywords: BIST, Brent Petrol, VAR Analysis, DCC-GARCH, Stock Indices, Tourism
JEL Classifications: B26, C58, G14, G15, O16

1. INTRODUCTION

Production is an extremely important element in terms of economic activities. One of the most important inputs for production is undoubtedly energy. Energy is needed in almost all processes carried out to deliver goods and services to consumers, both in the manufacturing sector and in the service sector. Energy is used at every stage, from supply to production, and from production to distribution. Although today's developing technology, scarcity of energy resources, and environmentalist approaches cause energy resources to change, petroleum, which is the most traditional energy resource, maintains its share in energy resources. It is estimated that oil makes up about one-third of total energy consumption and is therefore the most common energy source (Bashir, 2022. p. 22801). Although concepts such as "green energy," "renewable energy," and "carbon footprint" are indicators of the transformation in energy resources, alternative energy sources have not yet been developed at the level desired to compete with oil. For this reason, oil prices are extremely important for the economy of the country, considering the abundance of petroleum and energy resources produced from oil in both commercial and social life and their usage areas. For this reason, consumers, companies, investors, and ultimately policymakers, who form the basic building blocks of national economies, closely follow oil prices in terms of the sustainability of financial stability.

There have been significant fluctuations in oil prices in the last 10-15 years. These variations can be examined over 3 time periods. The first period in which significant volatility emerged in oil prices was after the 2008 financial crisis. With the increasing oil demand from China, the oil price, which reached $145 in 2008, dropped to $30 on December 23, 2008, due to the impact of the crisis. After rising to $80 levels again in 2009, it remained in the range of $90 and $120 for a long time. The second important cause of volatility in oil prices emerged with the shale gas revolution in the USA. Oil prices declined to $36 levels on December 11, 2015. The third period of volatility in oil prices is undoubtedly the period when the COVID-19

pandemic emerged. In this period, two important developments affected oil prices. The first of these is the supply shock that emerged as a result of the failure of Russia and Saudi Arabia to agree on reducing oil production in March 2020. In this period, Saudi Arabia increased its oil supply by approximately 25% to approximately 12.3 million barrels per day, and this caused a 30% decrease in oil prices. The second important development affecting oil prices during the COVID period is the decrease in demand for oil as a result of the restrictions in production, logistics, and transportation that emerged due to the measures taken by the countries. In particular, the decrease in oil demand in China by more than 20% caused the most important oil demand shock after 2008, causing oil prices to reach the lowest levels since the 1980s (Jawadi and Sellami, 2021. p. 2). It is an important source of energy for the economy, and oil prices are an important indicator for economic stability due to the dependence of economic activities on oil. Changes in oil prices affect economic activities in terms of supply and demand. Increases in oil prices, in particular, cause slowdowns in the supply of goods and services by increasing production costs. When high oil prices are evaluated in terms of demand, they reduce the purchasing power of individuals and affect economic activities by causing a decrease in consumption expenditures (Alamgir and Amin, 2021.p. 693-694). When evaluated on a global scale, fluctuations in oil prices in international markets affect the economic stability of countries, and therefore oil prices are of vital importance for almost all countries. In addition, today, oil has become more than just an economic variable; it has become an important bargaining chip in international political, military, and diplomatic relations (Das, 2021.p. 130-31).

An important economic factor affected by the increase in oil prices is the financial markets and stock markets, which are among the most important actors in these markets. For this reason, there are approaches to the relationship between oil prices and stock market indices in the finance literature. Increases in oil prices adversely affect the stock market indices due to reasons such as increasing input costs, negatively affecting economic growth, increasing the general level of prices, and decreasing the profitability of companies. In addition to these, the increasing risk and the emerging uncertainty environment associated with the rise in oil prices are also closely related to the markets. Therefore, the increase in oil prices causes an increase in the share allocated to energy expenditures and a decrease in profitability, leading to a decrease in stock market indices (Alamgir and Amin, 2021. p. 693-694). In addition, since not all countries in the world have oil reserves, the production and therefore the economic activities of oil-importing countries depend on the oil they will import from other countries. For this reason, the relationship between oil prices and the stock market differs in terms of oil exporting or importing countries (Golder et al., 2020. p. 135). Supply- and demand-side imbalances in the markets determine the movements in the oil and stock markets. Since there is a constant flow of information in these markets, there is no shortage of information that prevents the estimation of prices, and the markets react to such positive or negative information and news. These reactions affect the decision-making processes of both investors and governments (Fasanya et al., 2021.p. 1).

Stock indices have always been a major concern for both policymakers and investors around the world, and the links between the oil price, exchange rate, and stock market indices have been considered important because of their important role in the development of the economy. Therefore, understanding the relationships between these variables helps investors make investment decisions and contributes to policy makers' designing policies to maintain market stability (Nguyen et al., 2020. p. 143). Although petroleum and energy sources obtained from petroleum are used in almost every field of economic and social life, the dependence on petroleum products, especially in the fields of chemistry, plastics, and transportation, comes to the fore. For this reason, it is expected that the changes in oil prices will primarily affect the companies operating in these sectors or the stock market indices in which these companies are traded. From this point of view, it is also possible to evaluate the effects of oil prices on stock market indices on a sectoral basis. Plastics, chemicals, and transportation sectors, where oil is used as a direct input, are more sensitive to changes in oil prices compared to other sectors. For this reason, the costs, revenues, and thus profitability of companies operating in the relevant sectors will be primarily and significantly affected by the changes in oil prices, and this will be reflected in the stock market performances.

In this study, the relationship between Brent oil prices and BIST indices is analyzed. For this purpose, the BIST-Chemistry, BIST-Transportation, BIST-Industrial, and BIST-100 indices, which are thought to be primarily affected by Brent oil prices, are included in the analysis. In the study, primarily information on the relationship between oil prices and stock market indices is presented, and in the following sections, a literature review, econometric methodology, a data set, findings, and conclusions are given, respectively.

2. LITERATURE REVIEW

There are many studies in the national and international finance literature that analyse the relationship between stock market indices and oil prices. Some of these studies are briefly described below, depending on whether they were done in the U.S. or abroad. In their 2016 study, Kendirli and Ankaya looked at the relationship between crude oil prices and the BIST-100 and BIST-Transportation indexes. They found that the BIST-100 index caused other variables to change and that the BIST-Transportation index caused crude oil prices to change in only one direction.

Sandal et al. (2017) used the Johansen cointegration and Granger causality tests to look at the link between the prices of crude oil and gold and the BIST-100 index. Oralbaykızı (2019) examined the relationship between oil prices and the BIST-100 and three different sector indices, concluding that the effect of changes in oil prices varied by sector. In their study, Bolük and Karkacier (2019) found that the tourism sector has a lot more potential than other sectors to create jobs and bring in money for the country. In his study, Kiraci (2019) analysed the relationship between oil prices, the Dollar index, the Dollar exchange rate, and the BISTTurizm index with Granger causality and Hatemi-J asymmetric causality tests, and asymmetric and Granger causality relationships were determined between the variables.

Kelikume and Muritala (2019) applied a dynamic panel analysis technique using quarterly data from 2010:1 to 2018:4 in their study examining the effect of oil prices on African stock markets. According to the analysis's findings, oil prices have a negative impact on stock markets in Africa.

Anyalechi et al. (2019) analysed the response of stock returns on the Nigerian Stock Exchange for the period 1994-2016 to fluctuations in oil prices. According to the cointegration test results, changes in oil prices cause a positive but insignificant effect on stock returns in both the long and short run. Furthermore, the Bounds Test revealed that there was no long-term relationship between oil prices and stock market returns during the studied period.

Soyemi et al. (2019) analysed the direct and indirect effects of oil price shocks on the stock returns of energy sector companies in Nigeria using data for the period between 2007 and 2014 and determined that oil price shocks directly affected the stock returns of the companies. Summary information on some of the recent studies on the subject of research in the national finance literature is presented below.

Nguyen et al. (2020) used daily data from August 1, 2000, to October 25, 2019 in their study investigating the effect of oil prices and exchange rates on two Vietnamese stock market indices, the VN index and the HXN, and found that oil prices had a significant positive effect on both indices. In terms of stock index volatility, it has been determined that both VN index and HNX index volatility are negatively affected by oil returns.

Golder et al. (2020) used the Johansen Cointegration Test, the Vector Error Correction Model, and the Granger Causality Test in their study investigating the effects of foreign exchange reserves, exchange rates, and crude oil prices on the stock index of the Dhaka Stock Exchange. According to the analysis findings, no causal link was found between Dhaka Stock Exchange indices and crude oil prices, and it was determined that all macroeconomic factors selected according to the Impact-Response function had a long-term permanent effect on the Dhaka Stock Exchange index.

In his study, Kiraci (2020) analysed the relationship between oil prices, the Dollar index, and the BIST-Transportation index using daily data for the period 2000-2018 with Granger causality and Hatemi-J asymmetric causality tests and, according to the findings, positive or negative shocks in oil prices.

It has been determined that the same directional shocks may occur in the BIST-Transportation index in the case of Yavuz and Salam (2020) analysed the relationship between stocks and oil price shocks using the data of the BIST index and Brent oil prices, and an inverse relationship was found between the variables. It was also determined that increases in oil prices cause a stronger negative asymmetric relationship compared to decreases.

Ajala et al. (2021), in their study investigating the effects of oil prices on stock prices and exchange rates in Nigeria, used the NARDL model and revealed that changes in oil prices affect exchange rates and stock prices asymmetrically.

Alamgir and Amin (2021), in their study, examined the relationship between the stock market indices of 4 South Asian countries and oil prices for the period 1997-2018 with the NARDL model, and according to the analysis findings, there is a positive relationship between the oil price and the stock market index. In addition, the reaction of the stock market index to positive and negative oil price shocks has an asymmetrical nature. In the study, it was determined that the Efficient Market Hypothesis is not valid for South Asian countries.

Asaad (2021), in his study, analysed the relationship between oil price, gold price, exchange rate, and Iraqi Stock Exchange stock prices. In his study, which used the ARDL cointegration test and Granger causality test, it was determined that there was no cointegration between the variables in the pre-Covid-19 period, and the effects of oil price, gold price, and exchange rate on Iraqi Stock Exchange stocks were insignificant according to the results of the short-term model.

Das (2021) discovered that shocks in developed markets had a spillover effect in the Indian market in his study in which he investigated the relationship between stock returns, exchange rates, and crude oil prices in the Indian Stock Exchange between 1999 and 2021 using wavelet analysis technique.

Endri et al. (2021), in their study aiming to determine the economic variables that affect the stock returns of mining sector companies traded on the Indonesian Stock Exchange, determined that oil prices have a positive and significant effect on the stock returns.

Fasanya et al. (2021), using the weekly data set between 1992 and 2016, used the ARDL and NARDL models to analyse the relationship between oil prices and stock returns in the Gulf Cooperation Council countries. They discovered that the risks are highly dependent on the oil price specification.

Jawadi and Sellami (2021), in their study in which they examined the effect of the change in oil prices in the USA on the stock market, exchange rate, and real estate market in the last 10 years, showed that oil prices had significant effects on the US stock market and the US dollar rate during the COVID-19 period, but no significant effect on the US real estate market. In the study, it was also determined that the stock market gave a positive and significant reaction to an oil price shock, which could be explained by the effect of high oil financialization in the last decade.

In his study, Nwosa (2021) examined the impact of the COVID-19 pandemic on the oil price, exchange rate, and stock market performance in Nigeria from December 1, 2019, to May 31, 2020. In the study, it was determined that COVID-19 had negative effects on oil price, exchange rate, and stock market performance, and it was concluded that these negative effects were more effective than those of the 2009 and 2016 global recessions. He also determined that oil prices have a high effect on the exchange rate and stock market performance.

Shi and Kong (2021), in their study examining the impact of international crude oil prices on energy stock prices in China during the COVID-19 epidemic, found that COVID-19 significantly strengthened the correlation between the variables and the volatility between oil price returns and energy stock returns has been found to have a spreading effect.

Temel and Eryiğit (2021), in their study investigating the relationships between energy prices and various BIST indices using daily data between January 1, 2007 and October 31, 2017, did not find a long-term relationship between energy prices and indices. In the short term, they determined that energy prices had a positive effect on BIST indices. In addition, they concluded that the underlying cause of the natural gas index, the food and beverage index, and the chemical petroleum plastics index was oil prices.

Demirkale and Can (2021) applied VAR and impact-response analysis using monthly data from 2008 to 2020 to analyse the relationships between the dollar exchange rate, interest rates, oil prices, and the BIST tourism index. The analysis results show that oil prices have a positive and weak influence on the BIST Tourism Index.

Karakuş (2021), in his study, analysed the relationship between natural gas and oil prices and the stock prices of companies traded in the BIST-Industrial index with the panel cointegration test, and according to the findings, cointegration between oil and stock prices was determined and the increase in oil prices affected the stock prices in the same direction.

In Tüzemen's study from 2021, he used the VAR-EGARCH model to look at how changes in oil prices affected the BIST service sector in different ways. This was done to figure out the asymmetric volatility pass-through from oil prices to the stock prices of companies in the service sector.

Vural and Azizoğlu (2021), in their study where they analysed the relationship between the change in foreign exchange and energy prices, the BIST-Industrial index return, and the stock returns of manufacturing sector companies, used the multivariate regression method and the change in dollar exchange rate and Brent oil prices to calculate stock returns at the 1% significance level. It has been determined that it has explanatory power and a positive relationship between the variables.

Zelka and Yıldırım (2021), in their study in which they analysed the relationship between the exchange rate, Brent oil prices, GDP, and the BISTUization index, applied causality analyses using data from the first quarter of 2002 to the fourth quarter of 2020. According to the results, it has been determined that there is unilateral causality from oil prices and exchange rates to the sector index.

Altnöz and Umut (2022) analysed the effects of changes in exchange rates and oil prices on BIST indices with the Johansen Cointegration Test, and according to their findings, although the effect of changes in oil prices on most sector indices is positive, this relationship is significant for a small number of sectors.

Ahmed and Mohammad (2022), in their study, compared and analysed the relationship between daily returns on the Pakistan Stock Exchange and oil prices for the period before and after COVID-19. In the study, VAR analysis and the Granger Causality Test were applied, and according to the analysis findings, oil shocks are inversely proportional to daily firm stock returns, and the adverse effect increases even more during the epidemic period. In addition, it has been determined that stock prices have no effect on oil prices.

Katsampoxakis et al. (2022) applied the VAR model and Granger causality test in their study, in which they examined the interrelationships between crude oil prices and stock returns in oil importing and exporting European countries during the COVID-19 period. According to the findings of the analysis, there is no interdependence between crude oil and stock prices in the stable periods before the COVID-19 epidemic and after the announcement of the vaccines, while the causality from stock markets to oil prices increases during periods of high volatility, and these developments show that both research countries are equally skeptical was found to be affected.

Atif et al. (2022) examined stock returns and oil price changes for oil exporting and importing countries with the help of Granger causality, action-response, and variance decomposition tests. The results of the causality test showed that after the decline in oil prices due to the COVID-19 pandemic, the interdependence between oil and stock price changes increased, and the causality from oil to stocks accelerated, especially during the rapid outbreak of the COVID-19 pandemic. In addition, it has been determined that the changes in oil prices have a greater effect on oil-exporting countries.

Tien (2022), in his research examining the asymmetrical relations between global oil prices and selected Vietnamese macroeconomic indicators, determined that there is a strong relationship between the macroeconomic factors examined and the changes in oil prices. In addition, according to the analysis findings, it has been determined that oil prices have a positive effect on the exchange rate, inflation, GDP, and stock market prices.

Güneş and Kaya (2022) used a Granger causality test to examine the short-term correlation between Brent oil prices and the BIST-100, BIST Chemical, BIST Industrial, and BISTU indices. The DCC-GARCH model's results indicated a positive correlation between the BIST-100, BIST-Chemistry, the BIST-Sinai, and the BIST Transportation indices, but no association between Brent oil and these other variables.

3. DATASET AND ECONOMETRIC METHODOLOGY

In the study, the short-term causality relationship between Brent oil, crude oil, and natural gas prices and the XTRZM sector index and dynamic conditional correlation situations were analyzed (Table 1). The date of February 1, 1997, was taken as the beginning of the data set. Analyses were carried out over the monthly closing

values between February 01, 1997 and December 01, 2022. Analyses were made by taking the natural logarithms of the series. The data were taken from the investing.com site, and the analyses were carried out with the help of the Eviews 10 application.

There are many studies and methods in the literature on determining the possible relationship between the variables. There are two variables, X and Y, in the Granger causality test, which is among the traditional causality tests. If the use of the historical data of the X variable in the estimation of the Y variable gives better results than the case of not using it, it is stated that the X variable is the Granger cause of the Y variable. As seen here, it actually refers to a correlation between the current value of any variable and the past values of other variables. For the Granger causality test, the VAR model is estimated in the first step.

$$Y_t = \alpha_1 + \sum \beta_i X_t - i\ n_i = 1 + \sum \gamma_j\ Y_{t-j}\ m_j = 1 + e_{1t} \quad (1)$$

$$X_t = \alpha_2 + \sum \theta_i X_t - i\ n_i = 1 + \sum \delta_j\ Y_{t-j}\ m_j = 1 + e_{2t} \quad (2)$$

The model is formulated as above. In the formula, e_{1t} and e_{2t} denote uncorrelated white noise error terms, and m denotes the appropriate lag length. If the F statistical value calculated as a result of the analysis exceeds the F critical value (3.5) or the probability value is 0.05, it is concluded that there is a causal relationship between the variables (Akkuş, 283. p. 2021). The impact-response function reveals how both the variables themselves and others react to a unit shock given to the variables in the VAR model and how long the response is damped. The response of endogenous variables in the model to random shocks in the error term is measured. In other words, it is revealed how the endogenous variable responds to a one-unit shock given to the error term. One of the important points to be considered here is that the variables must meet the stationarity condition in order for the shock to be dampened after a certain period of time and the relationship between the variables to be correctly determined. DCC, or the dynamic conditional correlation model, was introduced to the literature by Engle (2002). In this model, predictions are made in two stages.

In the first step, the GARCH (1, 1) model is established and the GARCH parameters are predicted; in the second step, the conditional correlations between the series are estimated.

$$H_t = DtPtDt \quad (3)$$

$$D_t = diag\ (h_1,t\ 1\ 2,\ldots,\ hn,t\ 1\ 2) \quad (4)$$

In the equation, Ht is an n x n conditional covariance matrix; Pt is a conditional correlation matrix; and Dt, on the other hand, represents the diagonal matrix with time-varying standard deviations on the diagonal.

$$Q_t = (1 - \alpha - \beta)M + \alpha\varepsilon t - 1\acute{\varepsilon}t - 1 + \beta Qt - 1 \quad (5)$$

t represents the n x n unconditional matrix of the standard error t, where is positive and is a non-negative scalar parameter. One of the most important advantages of this model is that the number of parameters estimated in the correlation process is independent of the number of series to be estimated. Therefore, when predicting large covariance matrices, this provides a significant numerical advantage (Mandaci and Kırkpınar, 2022. p. 575).

4. RESULTS

The findings section starts with descriptive statistical information about the variables and ends with the unit root test, causality, action-response function, and dynamic conditional correlation analysis.

According to the information presented in Table 2, XTRZM index (0.013401 ± 0.159759), Crude oil WTI variable (0.004443 ± 0.111336), Natural gas variable (0.002900 ± 0.155727), Natural gas variable (0.002900 ± 0.155727) and brent oil variable (0.004893 ± 0.100413) values are included. However, the fact that the mean and median (median) values of the variables are the same or very close to each other indicates that the distribution is symmetrical. If the distribution is symmetrical, there is strong evidence that these variables are normally distributed. As a matter of fact, since the Jarque-Bera test probability values of the variables used in the study were P > 0.05, it was seen that the XTRZM index, crude oil, natural gas, and Brent oil price variables were normally distributed. In summary, according to the logarithmic values of the variables, XTRZM has the highest average value and the natural gas variable has the lowest value. According to the volatility values, XTRZM has the highest volatility with 0.159759, and Brent oil has the lowest volatility with 0.100413.

To test the stationarity of the series, the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests are performed and presented in Tables 3 and 4 below.

Table 3 shows the results of the PP (Phillips-Perron) unit root test of the variables. Taking into account the level and 1st difference values of logarithmic series, it is clear that the level of all series is constant.

Table 1: Description of variables

Variables	Explanation	Source
LNXTRZM	BIST-tourism	investing.com
LNBRENT	Brent oil	
LNWTI	Crude oil	
LNNG	Natural gas	

Table 2: Descriptive statistics variables' outcomes

	LNXTRZM	LNWTI	LNNG	LNBRENT
Mean	0.013401	0.004443	0.002900	0.004893
Median	0.008924	0.015589	0.006200	0.011012
Maximum	0.662652	0.633269	0.486205	0.356977
Minimum	−0.822144	−0.781866	−0.538135	−0.633933
SD	0.159759	0.111336	0.155727	0.100413
Skewness	−0.210322	−0.804258	−0.088285	−1.017175
Kurtosis	8.171507	13.49352	4.083394	8.870808
Jarque-Bera	347.7352	1455.724	15.56354	498.6474
Probability	0.000000	0.000000	0.000417	0.000000
Sum	4.154458	1.377264	0.899121	1.516787
Sum Sq. Dev.	7.886557	3.830306	7.493520	3.115606
Observations	310	310	310	310

Table 4 shows the results of the ADF (Extended Dickey-Fuller) unit root test of the variables. According to the ADF test, it was determined that the logarithmic series are stationary in level. Granger causality analysis was used to examine the causal relationship between the variables without taking the first difference into account.

As it is known, for the VAR model established in the causality relationship between the series, the most appropriate lag lengths of the series in question must be correctly determined. According to Table 5, lag lengths of 0 and 3 for logarithmic series were found to be suitable for two, three, and four information criteria. In this case, the suitability conditions for all three lag lengths in the VAR model are tested. When the model is estimated over 3 lag lengths, it is seen that the values in the AR polynomial are within the unit circle. In other words, it is possible to make a VAR model over three lag length values, and analyses can be continued over this value.

During the estimation phase of the VAR model, once the right lag length has been found, the model's stability conditional state should be found. The AR polynomial graph is given in Figure 1. The points specified in the blue rectangle must be in the circle. In order to ensure the stability condition, the blue dots must be located within the unit circle. After using the appropriate lag length of 3 in the VAR model, it was seen that the blue dots were located within the unit circle in the AR polynomial that emerged, and it was concluded that the established model estimation was appropriate.

The results of the Granger causality relationship between the variables are shown in Table 6. It has been determined that natural gas and Brent oil, Crude oil, and the XTRZM index are not causes of one another. Since Brent oil and Crude Oil WTI are not XTRZM indices, it has been determined that there is a one-way Granger causality relationship between the XTRZM index and Brent oil and Crude Oil WTI.

Tablo 3: Unit root test table Phillips-Perron

Variables	With constant		With constant and trend		Without constant and trend	
	T-statistic	P	T-statistic	P	T-statistic	P
At level						
LNXTRZM	−16.05	0.0000***	−16.0496	0.0000***	−16.0016	0.0000***
LNBRENT	−14.804	0.0000***	−14.7844	0.0000***	−14.8219	0.0000***
LNWTI	−15.2946	0.0000***	−15.2746	0.0000***	−15.2772	0.0000***
LNNG	−18.5149	0.0000***	−18.4879	0.0000***	−18.5381	0.0000***
At first difference						
d (LNXTRZM)	−144.876	0.0001***	−145.43	0.0001***	−144.333	0.0001***
d (LNBRENT)	−110.236	0.0001***	−110.077	0.0001***	−110.495	0.0001***
d (LNWTI)	−99.9459	0.0001***	−99.7006	0.0001***	−100.191	0.0001***
d (LNNG)	−108.065	0.0001***	−107.442	0.0001***	−107.851	0.0001***

*Significant at the 10%, **Significant at the 5%, ***Significant at the 1%. And (no) not significant

Table 4: Augmented dickey-fuller unit root test results of variables

Variables	With constant		With constant and trend		Without constant and trend	
	T-statistic	P	T-statistic	P	T-statistic	P
At level						
LNXTRZM	−16.1021	0.0000***	−16.1097	0.0000***	−16.0254	0.0000***
LNBRENT	−14.9734	0.0000***	−14.9572	0.0000***	−14.9681	0.0000***
LNWTI	−15.3889	0.0000***	−15.3701	0.0000***	−15.3923	0.0000***
LNNG	−15.0009	0.0000***	−14.9811	0.0000***	−15.0185	0.0000***
At first difference						
d (LNXTRZM)	−11.4815	0.0000***	−11.4734	0.0000***	−11.5015	0.0000***
d (LNBRENT)	−14.0776	0.0000***	−14.0551	0.0000***	−14.1012	0.0000***
d (LNWTI)	−14.3288	0.0000***	−14.3058	0.0000***	−14.3529	0.0000***
d (LNNG)	−9.7788	0.0000***	−9.7492	0.0000***	−9.7955	0.0000***

*Significant at the 10%, **Significant at the 5%, ***Significant at the 1%. And (no) not significant

Table 5: Results of information criteria for determination of appropriate lag length

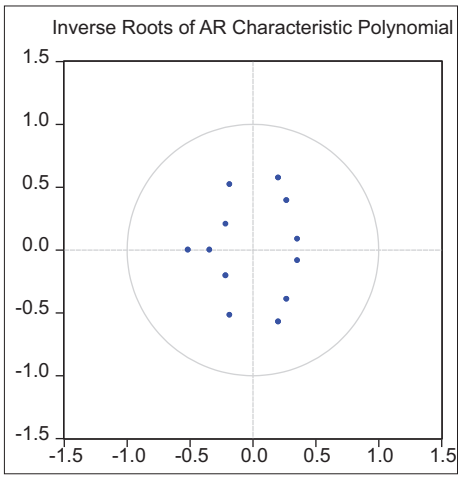
Lag	Log L	LR	FPE	AIC	SC	HQ
0	1126.275	NA	6.96e-09	−7.432282	−7.383137*	−7.412619*
1	1151.191	49.00823	6.56e-09	−7.491333	−7.245609	−7.393016
2	1169.074	34.70025	6.48e-09	−7.503803	−7.061501	−7.326833
3	1185.353	31.15567*	6.46e-09*	−7.505648*	−6.866767	−7.250024
4	1197.999	23.86801	6.61e-09	−7.483435	−6.647975	−7.149157
5	1205.559	14.06939	6.99e-09	−7.427544	−6.395505	−7.014612
6	1215.612	18.44085	7.28e-09	−7.388157	−6.159539	−6.896572
7	1222.039	11.62083	7.76e-09	−7.324764	−5.899567	−6.754525
8	1231.323	16.53844	8.13e-09	−7.280285	−5.658509	−6.631392

*Lag order selected by the criterion. NA: Not available

The results of the impact-response analysis performed to determine the effect of the shock given to one of the variables in the VAR model on the other variables are given in Figure 2. Here, only the responses of the variables to the shocks originating from the XTRZM index are shown, not the action-response situations among all the variables. When we look at the standard impulse-response graphs, the reaction of natural gas to the shock belonging to the tourism index is positive, and its effect decreases after 2 months. In this case, it is seen that the classical effect is valid. The reaction of the tourism sector to the shock in natural gas is positive after 5 months.

Oil, Crude Oil WTI, and Natural Gas are examined, the reactions of natural brent oil, gum oil, and gas to the tourism index shock are positive, and they are 4-5 months old. Then the effect diminishes. In other words, it is seen that the classical effect is valid (Figure 3).

Figure 1: AR polynomial graph representation



In order to determine whether there is a volatility relationship between the variables, the DCC-GARCH model was used, and the results are shown in Table 7. According to the results, it has been determined that there is no volatility relationship between the Borsa Istanbul Tourism Index and Brent oil, crude oil, or natural gas.

Table 6: Granger causality results

Excluded	χ^2	df	P
Dependent variable: LNXTRZM			
LNBRENT	3.238688	3	0.3563
LNWTI	4.800461	3	0.1870
LNNG	3.921876	3	0.2700
All	24.64813	9	0.0034***
Dependent variable: LNBRENT			
LNXTRZM	18.63890	3	0.0003***
LNWTI	2.419393	3	0.4900
LNNG	1.327480	3	0.7226
All	21.37160	9	0.0111**
Dependent variable: LNWTI			
LNXTRZM	16.01258	3	0.0011***
LNBRENT	8.920623	3	0.0304**
LNNG	1.709755	3	0.6348
All	24.62756	9	0.0034***
Dependent variable: LNNG			
LNXTRZM	1.549433	3	0.6709
LNBRENT	3.439334	3	0.3287
LNWTI	4.116479	3	0.2492
All	21.36874	9	0.0111**

*Significant at the 10%, **Significant at the 5%, ***Significant at the 1%. levels, respectively.

Table 7: DCC-GARCH results

Variable	Coefficient	SE	T-statistic	P
LNBRENT	−0.113079	0.300469	−0.376343	0.7069
LNWTI_	0.274840	0.271500	1.012301	0.3122
LNNG	−0.094253	0.059415	−1.586344	0.1137

SE: Standard error

Figure 2: Impact-response analysis results between brent petroleum, crude oil WTI, natural gas, and BIST tourism index

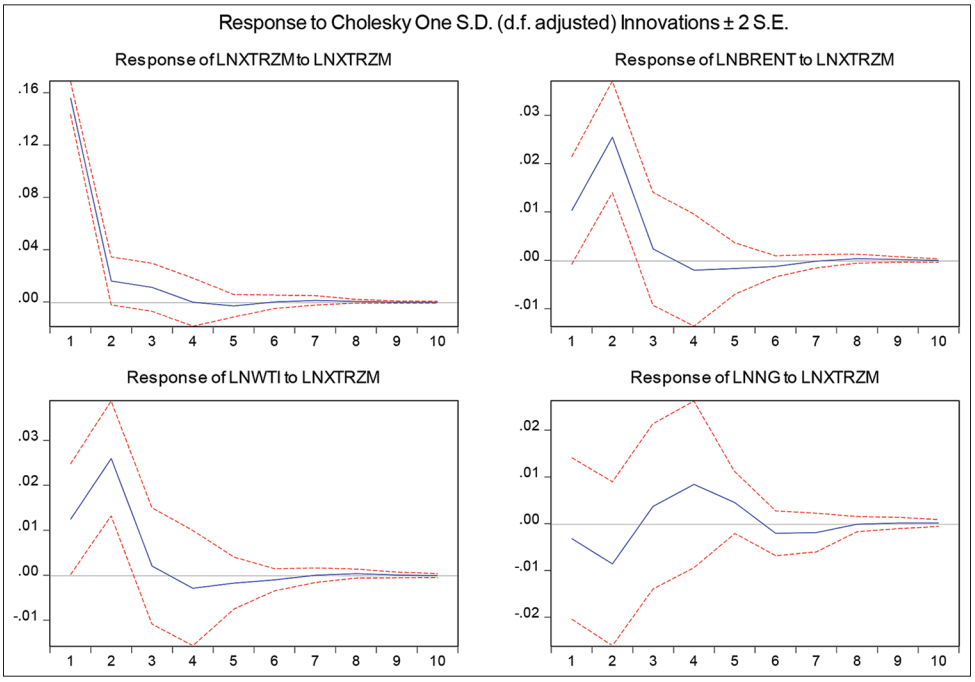
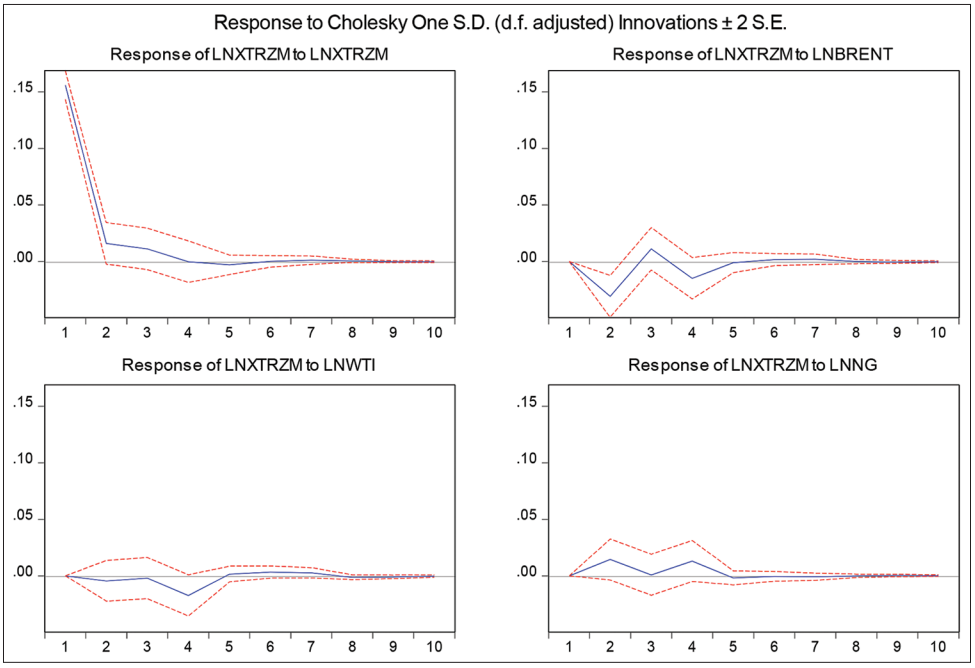


Figure 3: When the impact-response analysis results between the BIST tourism index and brent



5. CONCLUSION

The prices of oil and natural gas, which are the main energy sources, are one of the most difficult situations that have left the whole world in a difficult economic situation in recent years. This study was conducted to determine the causality and dynamic conditional correlation relationship between Brent oil, crude oil, and natural gas prices and the tourism index in the Turkish stock market. Brent oil, crude oil, and natural gas were taken as energy sources, and the Borsa Istanbul Tourism index was taken to represent the stock market. The tourism index has been used in the study since it is thought to be closely related to oil prices. Monthly closing values between January 1997 and December 2022 were used in the analyses. Analyses were performed by taking the natural logarithm of the monthly closing values of the series.

According to the results of the Granger causality relationship, it was concluded that Natural gas and Brent oil, Crude oil and XTRZM index were not the cause of each other. Brent oil and Crude Oil (WTI) is not part of the XTRZM index. However, it has been determined that there is a one-way Granger causality relationship from XTRZM index to Brent oil and Crude Oil.

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