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THE RELATIONSHIP BETWEEN OIL PRICES AND STOCK PRICES: EVIDENCE FROM BIST SECTORS

Mesut ASLAN[1]

Abstract

One of the most important energy resources in the world oil plays an important role in the economy. Nowadays, oil has the feature of being the most preferred energy source with a share of 33% in energy consumption in the global arena. In addition to the fact that oil prices affect economic activity, it is generally thought that oil prices are affected by stock prices. The aim of this study is to examine the long- and short-term relationship between stock prices and oil prices in the sectors covered by Borsa Istanbul (BIST) through daily data for the 2003-2021 period. Vector error correction model (VECM) and Granger causality test based on Vector Auto-Regressive (VAR) system were used. According to the results, there is no causality relationship from oil prices to stock prices, but there is a causal relationship from stock prices to oil prices. Therefore, it has been suggested that investors operating in the oil market should follow the changes in stock prices.

Anahtar Kelimeler: BIST, Stock, Granger Causality Test.

Jel Codes: G17, G32

[1]Res. Assist. Dr., Bingöl Unıversıty, Faculty of Economics and Administrative Sciences, Department of Business Administration, mesutaslan@bingol.edu.tr, 0000-0003-2338-7474

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PETROL FİYATLARI İLE HİSSE SENETLERİ FİYATLARI ARASINDAKİ İLİŞKİ: BIST SEKTÖRLERİNE YÖNELİK BİR ANALİZ

Öz

Dünyadaki enerji kaynaklarının en önemlilerinden biri olan petrol ekonomide önemli bir rol oynamaktadır. Günümüzde petrol küresel alanda enerji tüketimi içerisinde %33'lük payı ile en fazla tercih edilen enerji kaynağı olma özelliğine sahiptir. Petrol fiyatları ekonomik aktiviteyi etkilemesinin yanında, genel olarak petrol fiyatlarının hisse senedi fiyatlarından etkilendiği düşünülmektedir. Bu çalışmanın amacı, Borsa İstanbul (BIST) kapsamında bulunan sektörlere ilişkin hissesenedi fiyatları ile petrol fiyatları arasındaki uzun ve kısa dönemli ilişkiyi 2003-2021 dönemi günlük verileri aracılığıyla incelemektir. Çalışmada vektör hata düzeltme modeli ve VAR sistemine dayalı Granger nedensellik testi kullanılmıştır. Yapılan analizler sonucunda petrol fiyatlarından hissesenedi fiyatlarına doğru bir nedensellik ilişkisi olmadığı, fakat hissesenedi fiyatlarından petrol fiyatlarına doğru bir nedensellik ilişkisi olduğu tespit edilmiştir. Bu nedenle petrol piyasasında faaliyette bulunan yatırımcılara hisse senedi fiyatlarında meydana gelen değişiklikleri takip etmeleri gerektiği önerisi sunulmuştur.

Anahtar Kelimeler: BIST, Hisse Senedi, Granger Nedensellik Testi.

Jel Kodları: G17, G32.

1. INTRODUCTION

Friedrichs (2011) states that as long as the lives of industrial societies is in danger, various topics such as energy supply and climate change will not be normal scientific topics. Based on this statement of Friedrichs, energy needs, which have the power to affect social development, can maintain their currency as an important agenda item in the economies of countries. It is possible to say that oil, which is the most important of these energy sources, has a great impact on economic activities, considering that it is the most traded subject in the world.

From the beginning of the industrial revolution to the end of the 19th century, the invention of steam engines made oil an even more important source of energy. (Stern, 2011). Although this energy source is well known in ancient civilizations, the demand for this energy source has increased with the widespread production of combustion engines. One ofthe main energy sources oilin the global arena is one of the most important raw materials in today's economies. Therefore, every sector in the economy becomes dependent on oil directly or indirectly (Hamilton, 2003). This dependency may vary depending on a numberof reasons suchas the size of the sector, globalization, international trade and technological effects. In this respect, it is very important to follow the changes in oil prices. While the increases in oil prices increase the costs for companies, While the increases in oil prices increase the costs for the companies, they also cause the general level of prices to rise. This generally leads to a weakening of purchasing power and a decrease in demand.

Economic expectation, since it is related to economic activities such as economic growth and financial markets, shocks in oil prices affect stock market prices. Investors can make their buying and selling decisions in any market not only according to the news in the local markets, but also according to the information they have obtained from other markets.

The impact of oil prices on cash flow is significant as many goods and services are used as inputs. An increase in oil prices will also affect cash flow as it increases production costs, and this will also be reflected in stock prices. Studies examining the effect of the increase in oil prices on stock market prices have not reached a consensus on the direction and magnitude of the effect.

The aim of this study is to examine the relationship between oil prices and stock prices by considering the BIST index, the main sector and many sub-sectors in Turkey. The rest of the study is as follows: Academic studies in the second part of the study, data set and methodology in the third part; In the fourth chapter, empirical results are mentioned. In the 5th part of the study, there is the discussion and evaluation part.

2. LITERATURE REVIEW

Numerous studies deal with the relationship between oil and stock prices. Jones and Kaul (1996) examined the relationship between oil prices and stocks. To this end they analyzed data from 1981 to 1986 for four countries (USA, Canada, Japan, and the United Kingdom). They used the Granger causality test in their study. They state that the change in oil prices in the post-war period had a negative impact on real stock returns. Huang et al. (1996) investigated whether there is a significant causal relationship from oil prices to stock returns. therefore, they used data from 1983-1990. As a result of the tests performed using Granger causality analysis, they stated that there is a causal relationship between the two variables. Sadorsky (1999) examined the relationship between oil price changes and real stock returns using US stock market data. For this purpose, he used quarterly data for the period 1947-1996. The GARCH method was used as the analysis method.

As a result of his analysis, he determined that the change in oil prices affected real stock returns. Maghyereh (2004) analyzed therelationship between oilprices and the returns of stock markets of 22 developing countries. Asa result of the analysis, ithas been determined that oilprice shocks have no effect onthe developing stock market index returns. Another study to investigate the effect of oil prices on the stock prices of 21 developing countries was conducted by Basher and Sadorsky (2006). They stated that oil price risk generally affects the

stock markets of developing countries and there is an unconditional and linear relationship between them. The effect of oil prices on the stock markets of four Gulf Cooperation Council member countries (Bahrain, Kuwait, Oman, and SaudiArabia) was analyzed by Maghyereh and Al-Kandari (2007). They use the data between 1996-2003 and stated that oilprices have a non-linear effecton the stock price indices of these countries. Similarly, Malik and Hammoudeh (2007) analyzed the relationship between oilprices and stocks in Gulf countries. According to their results, there is a spread of volatility and shock from the oil markets to all Gulf countries, but only from the Saudi Arabian marketto oil. Arouri et al. (2011) examined the relationship between crude oil prices and stock markets in Gulf countries. They stated that there is a short-term positive relationship in Qatar, UAE, and Saudi Arabia, and there is no relationship between oil prices and stock returns in the long run in other countries except Bahrain.

Guler et al. (2010) examined the effect ofthe change in oil priceson BIST energy sector stock prices. Regarding the results, they determined that oil prices and stocks have a long-term relationship. İşcan (2010) found that there is no long-term relationship between oil prices and stock prices in his study to determine the relationship between oil prices and the ISE100 index. In the study conducted to determine the effect of oil prices in Vietnam on daily stocks, Narayan and Narayan (2010) found that oil prices, stock prices and nominal exchange rateshave a long-term relationship.

Kapusuzoğlu (2011) analyzed the relationship between brent oilprices and the ISE 100, ISE 50 and ISE 30 indices. As a result of the analyzes he made using the data between 2000 and 2010, he stated that there is a one-way causality relationship from all indices to oil prices. On the other hand, Şener et al (2013) stated that thereis a long-term relationship between Borsa Istanbul closing prices and oil prices.

As can be seen inthe literature, thereare many studies examine the relationship between oilprices and stock prices. Some of the most important of these studies are given above. In general, different results have been obtained in the studies. For this reason, it is important that the study is handled with a different method and examined in a different time period. In this study, unlike other studies, a different time period was considered and a different analysis technique was used. For this reason, it is thought that this study will contribute to the finance literature.

3. DATA SET AND METHODOLOGY

In this study, the relationship between oil prices and stock prices was analyzed as BIST main sector and sub-sectors using daily datafor the period 2003-2021. The main sectors are considered as service sector, technology sector, industrial sector and finance sector. While the service sector includes sub-sectors of tourism, transportation, trade, communication and electricity sectors; technology sector includes defense and informatics sub-sectors. In the industrial sector, metal main, metal goods, food, paper and textile sub-sectors were considered as sub-sectors, and finally, banking, financial institutions, insurance and holding sub-sectors took place in the finance sector. For oil prices, daily brent oil sales price is used. All data in the study are logarithmic data. Variables are introduced in Table 1.

Table 1. Definitions of Variables

SERIES	DESCRIPTION
LOil	Logarithm of Brent Oil Sales Price
LAll	Logarithm of BIST All Price Index
SERVICE INDUSTRY	
YService	Total Stock Price Index of the Service Sector
Tourism	Stock Price Index of the Tourism Sector
Transport	Stock Price Index of the Transportation Sector
Trade	Stock Price Index for the Trade Sector
Communication	Stock Price Index of the Communication Sector
Electric	Stock Price Index of the Electricity Sector
TECHNOLOGY INDUSTRY	
YTechnology	Total Stock Price Index of the Technology Sector
Defense	Defense Sector Stock Price Index
Informatics	Stock Price Index of the IT Sector
INDUSTRIAL SECTOR	
Yindustrial	Total Stock Price Index of the Industrial Sector
MMai	Stock Price Index for the Metal Main Sector
MGoods	Stock Price Index of the Metal Goods Industry
Food	Stock Price Index for the Food Sector
Paper	Stock Price Index of the Paper Industry

Textile	Stock Price Index of the Textile Sector
FINANCIAL SECTOR	
YFinancial	Total Stock Price Index of the Financial Sector
Bank	Bank Sector Stock Price Index
Financial Institutions	Stock Price Index for the Financial Institutions Sector
Insurance	Stock Price Index of the Insurance Sector
Holding company	Stock Price Index of the Holding Sector

Stationarity condition check is the first step of the analysis. Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) unit root test test were used for this purpose.

The ADF test is based on the assumption thatthe error terms are randomly and homogeneously distributed. Since the error terms might be heteroskedastic and autocorrelated, I use an extended ADF test that may cover that situations (Takim, 2010). While the ADF test handles the error terms independently and homogeneously, the Philips-Perron test allows for a weak, dependent and heterogeneous distribution of the error terms.

For unit root tests, equations (1), (3), and (2), (4) are considered as fixed and constant-trend models, respectively. In orderto overcome the autocorrelation problem inthe ADF test, an explanatory variable is added to the right side of the equations. The Akaike Information Criterion was usedto determine the lag lengths ofthe dependent variable.

$$\Delta_{y_t} = \beta + \delta_{y_{t-1}} + \sum_{i=1}^{p} \emptyset_i \Delta_{y_{t-i}} + v_t \quad (1)$$

$$\Delta_{y_t} = \beta + \delta_{y_{t-1}} + \sum_{i=1}^{p} \emptyset_i \Delta_{t-i} + y\mathit{trend} + v_t \quad (2)$$

where y is the series of interest, β , δ, $\emptyset$ are coefficients, v_t denotes the error term and p isthe optimal lag length. The t statistic ofthe δ coefficient is compared with the McKinnon table critical values. If the absolute value of the t statistic has a value greater than the absolute value of the MacKinnon table critical value, it is indicate the stationarity at level.

The Phillips-Perron test uses equations (3) and (4) below:

$$\Delta_{y_t} = \beta + \delta_{y_{t-1}} + \mu_t \quad (3)$$

$$\Delta_{y_t} = \beta + \delta_{y_{t-1}} + (y\mathit{trend\text{-}T/2}) + \mu_t \quad (4)$$

where y is the series of interest, β , δ, $\emptyset$ are coefficients, μ is the error term and T is the number of observations. The stationarity of the series is determined by comparing the t statistic of the δ coefficient with the MacKinnon table critical value.

The Johansen-Juselius cointegration test was performed after the stationarity tests to determine whether there is along-term relationship between stock price indices and oil prices. This test is used to determine the long-run relationship of series that are stationary at the same level. The maximum likelihood estimation method is usedto obtain the cointegration vectors ofthe non-stationary series. The VAR model is used to estimate coefficients.

$$\Delta \mathbf{X}_t = \sum_{i=1}^{k-1} \Delta \mathbf{X}_{t-i} + \pi X_{t-k} + \delta + \eta_t \quad (5)$$

where $\mathbf{X}$ is the vector of non-stationary variables; δ constant coefficient; (π=$\alpha\beta$) α is the adaptation coefficient and β is the cointegration vector.

The test described by Johansen (1988) is based onthe relationship between the rank ofa matrix and its characteristic roots. According to the test, the coefficients of the characteristic roots can be found by the equations given below:

$$\lambda_{trace}(\mathrm{r}) = -\mathrm{T} \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad (6)$$

$$\lambda_{trace}(\mathrm{r}, \mathrm{r+1}) = -\mathrm{T} \ln(1 - \lambda_{r+1}) \quad (7)$$

where λ_i is the estimated values of characteristic unit roots, T is the number of observations, r is the number of cointegration vectors. According to the Johansen cointegration test, the calculated maximum trace and maximum eigenvalues are compared with the critical values defined by Johansen and Juselius (1990). If the calculated trace and maximum eigenvalue are greater than the critical values, it indicates a long-run relationship between the series.

Engle and Granger (1987) argued that in case of cointegration between variables, there should be at least one-way causality relationship. I used Engle and Granger causality test to identify a causal relationship between the series of cointegration. The error correction model is:

$$\Delta y_t = \alpha_1 \, \xi \mathrm{res1}_{\,t-1} + \sum_{i=1}^{p} \beta_i \, \Delta y_{t-i} + \sum_{i=1}^{p} \delta_i \, \Delta x_{t-i} + v_t \quad (8)$$

$$\Delta x_t = \alpha_2 \, \psi \mathrm{res2}_{\,t-1} + \sum_{i=1}^{q} \mathrm{y}_i \, \Delta X_{t-i} + \sum_{i=1}^{Q} \eta_i \, \Delta y_{t-i} + u_t \quad (9)$$

where p and q are the optimal lags, y and x are co-integrating variables, $res1_{t-1}$and $\mathrm{res2}_{t-1}$ are the lagged values of the error terms; ξ and ψ are error correction terms, β , δ , γ and η are coefficients, and α_1, α_2 are the constant terms. If δ_i in equation (8) and η_i in

equation (9) are statistically significant, or the coefficient of $res1_{t-1}$ is negative and statistically significant, it indicates a significant relationship between the series.

Granger (1969) causality analysis was used to reveal the short-term dynamics for the series that do not have a long-term relationship. For this purpose, the VAR system was used through equations (10) and (11):

$$\Delta y_t = \alpha_1 + \sum_{i=1}^{p} \beta_i \, \Delta y_{t-i} + \sum_{i=1}^{p} \delta_i \, \Delta x_{t-i} + v_t \quad (10)$$

$$\Delta x_t = \alpha_2 + \sum_{i=1}^{q} y_i \, \Delta X_{t-i} + \sum_{i=1}^{Q} \eta_i \, \Delta y_{t-i} + u_t \quad (11)$$

If the coefficients δ_i and η_i are statistically significant, it indicates a causal relationship between the variables.

4. EMPİRİCAL RESULTS

ADF and PP unit root tests of the variables were performed and the results are presented in Table 2. It has been determined that all series aren't stationary in level values according to both test results. Thus, the unit root test was performed by taking the first differences of the series and the results are presentedin Table 3. All series are stationary at the first differences.

Table 2. ADF and PP Test Results

Series	ADF		PP	
	Fixed	Fixed and Trending	Fixed	Fixed and Trending
LOil	-0.5733	-1.6781	-0.9364	-1.8883
LAll	-0.8635	-1.8437	-0.8473	-1.3672
SERVICE INDUSTRY				
LService	-0.8515	-2.0537	-0.7533	-1.9855
LTourism	-1.7557	-1.8543	-1.8366	-1.9753
LTransport	-0.1107	-0.6873	-0.1009	-0.7412
LTrade	-0.6657	-1.8537	-0.4519	-1.6537
LCommunication	-0.9567	-2.2597	-1.6719	-2.6669
LElectric	-0.7633	-1.7682	-0.8529	-1.8537
TECHNOLOGY INDUSTRY				
LTechnology	-0.4537	-0.9533	-0.2571	-0.7153

LDefense	-0.8883	-1.0502	-0.7511	-0.7863
LInformatics	-0.8227	-1.1535	-0.8119	-1.1327
INDUSTRIAL SECTOR				
Lindustrial	-0.8743	-1.7543	-0.7142	-1.3891
LMai	-1.2537	-1.9653	-1.3841	-1.7310
LMGoods	-0.8391	-1.6544	-0.4537	-0.8159
LFood	-0.2837	-1.8643	-0.3025	-1.9957
LPaper	-0.9315	-1.3791	-0.9444	-1.3927
LTextile	-0.6137	-1.5505	-0.2133	-0.9636
FINANCIAL SECTOR				
LFinancial	-1.2419	-1.8517	-1.2213	-1.7329
LBank	-15963	-1.9364	-1.6101	-1.9037
LFinancial Institutions	-1.4550	-1.7717	-1.4361	-1.4022
LInsurance	-1.8746	-1.9991	-1.6511	-1.7653
LHolding company	-1.1163	-1.4523	-1.0135	-1.4537
Note 1: The maximum number of delays is taken as 8. "L" denotes the logarithm of the series. *,**,*** denote stationarity at 1%,5% and10% significance levels, respectively. **Note 2:** Level valuesof variables are used.				

Table 3. ADF and PP Test Results

Series	**ADF**		**PP**	
	Fixed	**Fixed and Trending**	**Fixed**	**Fixed and Trending**
LOil	-9.5786*	-9.4322*	-41.7541*	-41.1513*
LAll	-9.5781*	-9.2337*	-38.2019*	-38.4751*
SERVICE INDUSTRY				
LService	-17.4533*	-17.3013*	-41.5793*	-41.2007*
LTourism	-39.5422*	-39.5544*	-39.5149**	-39.3555**
LTransport	-38.7952*	-38.8561*	-38.9287*	-38.9566*

LTrade	-8.7015*	-8.7396*	-41.3359*	-41.3257*
LCommunication	-16.7453*	-16.7352*	-43.5777*	-43.4537*
LElectric	-16.1557*	-16.1366*	-35.2983**	-35.2389***
TECHNOLOGY INDUSTRY				
LTechnology	-9.2367*	-9.3581*	-37.6922*	-37.6591*
LDefense	-7.6528*	-7.6639*	-33.6741*	-33.5537*
LInformatics	-16.8749*	-16.8891*	-37.5213*	-37.3566*
INDUSTRIAL SECTOR				
Lindustrial	-7.8714*	-7.8753*	-36.1227**	-36.1011**
LMai	-10.5479*	-10.5362*	-35.7842*	-35.6591*
LMGoods	-9.1593*	-9.1157*	-35.9328**	-35.9257**
LFood	-21.6395*	-21.6197*	-40.8738**	-40.7533**
LPaper	-38.4567*	-38.4163*	-37.4699*	-37.4537*
LTextile	-7.5716*	-7.5542*	-37.4397*	-37.5791*
FINANCIAL SECTOR				
LFinancial	-8.5445*	-8.6397*	-35.0499**	-35.0052**
LBank	-8.7888*	-8.7543*	-36.6711**	-36.5327**
LFinancial Institutions	-8.2146*	-8.8932*	-35.5219**	-35.4397**
LInsurance	-35.6271*	-35.6028*	-35.5329*	-35.1315*
LHolding company	-36.3987*	-36.3953*	-36.7553*	-36.6751*

Note 1: The maximum number of delays is taken as 8. "L" denotes the logarithm of the series. *,**,*** denote stationarity at 1%, 5% and 10% significance levels, respectively.

Note 2: Level values of variables are used.

It has been seen thatthe oil price series and the stock price index series are stationary at the first difference. For this reason, the long-term relationship between these variables is defined bythe Johansen cointegration test. The deterministic components of the cointegration equations were evaluated in terms of the fixed and trended components of the series. For this reason, the model in which there is no linear trend in the series and the constant in the

cointegration equation is used, and the models in which the series have a linear trend but only a constant in the cointegration equation are used.

The long-term relationship between stock price indices and oilprices hasbeen analyzed. The results of the Johansen co-integration test between the BIST price index and the oil price index are given in Table 4. The results indicate no long-term relationship between the series of interest.

Table 4. Johansen Cointegration Test Results (BIST All)

Long Term Relationship	H0	Trace Statistics	H0	Maximum Core Value Statistic
LOil-LAll	r= 0	13.8718 (0.2765)	r= 0	10.8393 (0.1579)
	r≤1	1.5743 (0.6773)	r=1	1.4688 (0.3965)

In Table 5, the long-term relationship between oil prices and stock price indices fortourism, transportation, trade, communication and electricity sub-sectors in the service sector has been tested. A long-term relationship between thestock price index of the tourism sub-sector and the oil price has been found. However, there is no relationship between the other sub-sectors and the oil prices.

Table 5. Johansen Cointegration Test: Service Sector

Long Term Relationship	H0	Trace Statistics	H0	Maximum Core Value Statistic
LOil-LService	r= 0	10.4537 (0.1325)	r= 0	9.3748 (0.1027)
	r≤1	1.0533 (0.1983)	r=1	1.0821 (0.1745)
LOil- LTourism	r= 0	13.5767** (0.0327)	r= 0	7.4637** (0.0252)
	r≤1	3.9721 (0.1057)	r=1	4.5362 (0.1109)
LOil-LTransport	r= 0	8.5437		8.3964

	r≤1	(0.1743) 0.1357 (0.9871)	r= 0 r=1	(0.0678) 0.07533 (0.4955)
LOil- LTrade	r= 0 r≤1	8.1024 (0.2453) 0.9119 (0.5871)	r= 0 r=1	7.9595 (0.2544) 0.5209 (0.4477)
LOil- LCommunication	r= 0 r≤1	13.4508 (0.4216) 1.2451 (0.3355)	r= 0 r=1	12.0893 (0.5123) 1.0537 (0.1359)
LOil-L Electric	r= 0 r≤1	7.8543 (0.1324) 1.8529 (0.1145)	r= 0 r=1	7.4513 (0.1533) 1.5537 (0.1154)
*,**,*** Denote the significance level of 1%, 5%, and 10%, respectively.				

The long-term relationship between the defense, information and technology sectors and oil prices has been tested, respectively, and the results are given in Table 6. Regarding the results, thereis no long-term relationship between stock prices and oil pricesin terms of the technology sector and its sub-sectors.

Table 6. Johansen Cointegration Test: Technology Sector

Long Term Relationship	**H0**	**Trace Statistics**	**H0**	**Maximum Core Value Statistic**
LOil- LTechnology	r= 0 r≤1	9.1368 (0.2543) 1.4219 (0.5771)	r= 0 r=1	9.5515 (0.1137) 0.3412 (0.3951)
LOil-LInformatics	r= 0	7.5237		6.4441

	r≤1	(0.1153) 0.6428 (0.2351)	r= 0 r=1	(0.3022) 0.7983 (0.2741)
LOil- LDefense	r= 0 r≤1	10.2311 (0.1952) 1.5327 (0.1745)	r= 0 r=1	8.5419 (0.3571) 1.5743 (0.1124)

In Table 7, the test results of the long-term relationship between the Metal Main, Metal Goods, Food, and Paper sub-price indices for the industrial sector and oil prices are presented. Theresults indicate that thereis a cointegration relationship between the stock price index of the total industrial sector and the metal goods sub-sector and the oil price index, but there is no relationship between the series inthe long run for other sectors.

Table 7. Johansen Cointegration Test: Industrial Sector

Long Term Relationship	**H0**	**Trace Statistics**	**H0**	**Maximum Core Value Statistic**
LOil- LİndustrialL	r= 0 r≤1	11.5745** (0.0342) 1.1124 (0.1549)	r= 0 r=1	10.6549** (0.0357) 1.2351 (0.1515)
LOil-LMai	r= 0 r≤1	8.8791 (0.2543) 1.9846 (0.1541)	r= 0 r=1	7.8779 (0.3451) 1.8455 (0.2228)
LOil- LMGoods	r= 0 r≤1	9.5749** (0.0245) 1.9543 (0.2223)	r= 0 r=1	6.6891** (0.0351) 1.9551 (0.2113)

LOil-LFood	r= 0 r≤1	17.7519 (0.2543) 2.5476 (3515)	r= 0 r=1	13.4897 (0.3541) 2.4543 (0.3791)
LOil-LPaper	r= 0 r≤1	7.9745 (0.2545) 0.5679 (0.2439)	r= 0 r=1	6.5487 (0.2877) 0.7955 (0.2746)
*,**,*** Denote the significance level of 1%, 5%, and 10%, respectively.				

In Table 8, the results of the analysis ofthe cointegration relationship between stock prices and oil pricesfor banks, financial institutions, insurance and holding sectors within the scope of the financial sector are given. It has been determined that the oil price does not move together with any price index in the long term.

Table 8. Johansen Cointegration Test: Financial Sector

Long Term Relationship	**H0**	**Trace Statistics**	**H0**	**Maximum Core Value Statistic**
LOil- LFinancial	r= 0 r≤1	9.8546 (0.1515) 1.7643 (0.1743)	r= 0 r=1	8.4535 (0.1723) 1.8543 (0.1739)
LOil-LBank	r= 0 r≤1	11.5781 (0.1357) 1.6855 (0.1541)	r= 0 r=1	9.4567 (0.2361) 1.7981 (0.3355)
LOil- L Financial Institutions	r= 0 r≤1	10.6870 (0.1023) 1.8443 (0.2519)	r= 0 r=1	9.9746 (0.2451) 1.5846 (0.1298)
LOil-LInsurance	r= 0	9.5777		7.6554

	r≤1	(0.4893) 1.8533 (0.3519)	r= 0 r=1	(0.2746) 1.9983 (0.1478)
LOil-LHolding company	r= 0 r≤1	8.9551 (0.3549) 1.0544 (0.1952)	r= 0 r=1	7.5541 (0.1983) 0.8746 (0.1551)
*,**,*** Denote the significance level of 1%, 5%, and 10%, respectively.				

All theresults of the cointegration tests reveal that the stock prices for the sectors where oil is used as an input have the same trend as the oil prices in the long run.

After examining the long-term relationship between oil price and stock price, Granger (1969) causality analysis and error correction model based on the VAR system was used to determine the short-term relationship.

The causality test results between all price indices and oil prices are given in Table 9. There is a one-way causality relationship from stock price to oil price at BIST total level.

Table 9. Granger Causality Test: BIST All

Causality Relationship	**Wald Testi (χ^2)**	**LM**	**Probability**	**Conclusion**
LOil → LAll	8.3571	4.8629	0.7695	LAll → LOil
LAll → LOil	21.4833**		0.0175	
*,**,*** Denote the significance level of 1%, 5%, and10%,respectively.				

The causality test results between services sector and oil prices are given inTable 10. According to the results, the direction ofcausality for the total services sector and the sub-sector of the services sector is from stock price to oil price. There is a one-way causality relationship from stock prices to oil prices in the communication and tourism sub-sectors. There is no causal relationship between other sub-sectors.

Table 10. Granger Causality Test: Service Sector

Causality Relationship	**Wald Testi (χ^2)**	**LM**	**Probability**	**Decision**

LOil→ LService	1.9833	2.8475	1.8695	LService→ LOil
LService→ LOil	18.5732**		0.0457	
LOil→ LTourism	1.2746	2.5792	0.7469	LTurizm→LPetrol
LTourism→LOil	0.1573**		0.0491	
LOil → LTransport	1.7535	4.9473	0.5749	No causality
LTransport→LOil	1.0697		0.6371	
LOil→LTrade	18.6941	4.7209	0.8793	No causality
LTrade→LOil	35.8943		0.9357	
LOil→LCommunication	8.9637	5.4777	0.4554	LİletişimLPetrol
LCommunication→LOil	29.6383*		0.0011	
LOil→LElectric	2.7639	5.8633	0.6791	No causality
LElectric→LOil	3.8761		0.4518	
*,**,*** Denote the significance level of1%, 5%,and 10%,respectively.				

The causality test results forthe technology sector are presented inTable 11. Regarding theresults, there is no causality relationship between stocks and oil prices for the technology sector.

Table 11. Granger Causality Test: Technology Sector

Causality Relationship	Wald Testi (χ^2)	LM	Probability	Decision
LOil→LTechnology	15.4327	0.5419	0.6588	No causality
LTechnology→LOil	19.3671		0.2419	
LOil→ LDefense	8.4511	1.2744	0.9357	No causality
LDefense→ LOil	14.3952		0.5083	
LOil→LInformatics	3.8744	3.1108	0.4117	No causality
LInformatics → LOil	8.6539		0.3519	

In Table 12, the results of the causality test between oilprices and stock prices for the industrial sector are presented. It has seen that thereis a one-way causality relationship from the total industrial sector to oil prices.

Table 12. Granger Causality Test: Industrial Sector

Causality Relationship	Wald Testi (χ^2)	LM	Probability	Decision

LOil→ LİndustrialL	13.4527	2.2149	0.6871	LİndustrialL→ LOil
LSınai→ LOil	12.5137**		0.0235	
LOil→LMai	15.4833	1.3408	0.5719	No causality
LMai → LOil	25.4107		0.6843	
LOil→LMGoods	14.2897	1.8841	0.3747	No causality
LMGoods → LOil	27.9418		0.4871	
LOil→LFood	11.4905	1.9055	0.8016	No causality
LFood → LOil	13.0577		0.6741	
LOil→LPaper	17.3954	5.5417	0.4740	No causality
LPaper → LOil	18.2113		0.3352	
LOil→LTextile	11.4873	2.3356	0.4554	No causality
LTextile→ LOil	13.4794		0.3776	
*,**,*** Denote the significance level of 1%, 5%,and10%,respectively.				

Table 13 presents the results of the causality test between oil prices and stock prices for the financial sector. The results indicate that the direction of causality is unidirectional from the total financial sector to oil prices.

Table 13. Granger Causality Test: Financial Sector

Causality Relationship	Wald Testi (χ^2)	LM	Probability	Decision
LOil→ LFinancial	8.5493	2.3744	0.8537	LFinancial →LOil
LFinancial → LOil	27.4151**		0.0132	
LOil→LBank	7.5741	2.5133	0.4567	No causality
LBank → LOil	15.3657		0.5111	
LOil→L Financial İnstitutions	13.2089	5.8845	0.3793	No causality
L financial İnstitutions → LOil	10.2577		0.4972	
LOil→LInsurance	6.3874	3.1895	0.7444	No causality
LInsurance → LOil	22.5015		0.3571	
LOil→LHolding company	11.5897	2.5688	0.6778	No causality
LHolding company→ LOil	27.4535		0.8713	
*,**,*** Denote the significance level of 1%, 5%, and10%,respectively.				

5. DISCUSSION AND CONCLUSION

Stock markets are the name given to the markets where the shares of companies that offer a certain part of their capital to the public can be bought and sold. These markets provide

various opportunities to companies that offer their capital to the public, and to individual and institutional investors participating in the country's economy and stock market. Through these markets, hot money can enter the country through international portfolio investments. When fund resources increase, fund costs decrease and this situation can provide a significant advantage to the economy through stock markets. In addition, stock markets can encourage people to save and enable people to play a role in the economy (Şan, 2014).

With the increase in industrialization, oil has become much more important for the world economy. Due to its widespread use, the demand for this product has increased within the supply-demand balance, and this has made oil gain a strategic importance apart from other energy sources. Producing and consuming countries have realized this importance of oil and the process of economic developments in the world has increased the dependence on oil.

Oil is a non-renewable energy source. This energy source is widely used both in production and fuel. Since the oil used in production affects the costs for the producers, it also affects the value of the firms. Therefore, a change in oil prices will also affectthe stock values of the transactions.

This study examines the relationship between stockprices and oil prices by using daily data forthe period 2003-2021. For this purpose, this relationship has been tried to be determined by considering the main sectors and sub-sectors listed in BIST. By using VECM and Granger causality test based on VAR system, short and long term relationship between oil prices and stock pricesis examined.

Regarding the results, a one-way causality relationship has been determined from the stock prices of the companies in the tourism sector to the oil prices, fromthe stock prices ofthe companies in the total industrial sector to the oil prices, and from the stock prices of the companies in the metal goods sector to the oil prices.

No causal relationship was found between oil prices and the technology sector. In addition, there is no causal relationship between transportation, trade and electricity prices, which are the sub-sectors of the service sector, and oil prices; between oil prices and the sub-sectors of the industrial sector, metal main, metal goods, food, paper and textile; It has been determined that there is no relationship between oil prices and the banking, financial institutions, insurance and holding sectors, which are the sub-sectors of the financial sector.

In this study it has been determined that oil prices don’t affect stock prices, on the contrary, stock prices can affect oil prices These results are supported by the studies of Chen et al

(1986), Bittlingmayer (2006), and Chittedi (2012). According to the results, the stock price index of none of the sectors can not be explained by oil prices. However, oil prices canbe explained by stock price indices. For this reason, it is recommended that investors operating in the oil market follow the changes in stock prices.

It is possible for researchers to analyze this relationship by considering the analysis period more broadly and using different techniques in new studies to be conducted.

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