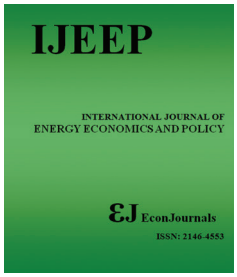

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Reflection of Brand Oil prices in the electricity index and BIST 100 index in Türkiye

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ABSTRACT

Investigating the relationship between changes in oil prices and individual stock prices can be useful in making more conscious decisions in financial markets, managing risks and better understanding economic developments. The aim of this study is to reveal how these changes affect the indices when oil prices, BIST 100 index and BIST electricity index change. For this purpose, BIST 100, BIST electricity index and oil price changes were subjected to Granger analysis in the time period of June 19, 2014-June 19, 2024. The obtained result reveals that there is a significant two-way relationship between BIST 100 index and BIST electricity index. On the other hand, no relationship was found between oil prices and the other two indices.

Keywords: BIST 100, BIST Electric, Oil, Oil Price, Granger Causality
JEL Classifications: O13, Q43

1. INTRODUCTION

Investors might get a tactical edge by investigating the connection between shifts in the price of specific stocks and changes in oil prices. Numerous studies have shown that one of the key factors influencing financial markets is the price of oil. In the context of contemporary economics, it is widely acknowledged that capital markets will react to any fluctuations in oil prices. Various political, economic, and financial crises show that the variability in oil and energy prices is greater (Regnier, 2007).

The market as a whole may be impacted by changes in oil prices, but businesses in industries like energy, manufacturing, and transportation are particularly affected. Making the best financial choices requires an understanding of these linkages. Companies in the energy industry may see an improvement in their profit margins if oil prices rise. For investors, this may provide possibilities. However, a rise in oil prices may result in higher expenses and lower profitability for businesses in some industries. Stock prices may suffer as a result. Investors are able to anticipate this circumstance and avoid firms that are adversely impacted.

The energy industry as well as the overall state of the economy may be impacted by changes in oil prices. Inflation and interest rates, which define overall market conditions, may be impacted by high oil prices. The following circumstances need to be taken into consideration in this situation:

- Interest rates and inflation: Central banks may raise interest rates in response to rising oil prices, which may also raise overall inflation. Conversely, high interest rates have the potential to lower stock prices. By anticipating this scenario, investors may improve their risk management.
- Importers and exporters of oil: While increasing oil prices may be detrimental to importing nations, they may be advantageous to exporting nations. By examining this condition, investors may assess the potential in both domestic and international markets.

Determining the variables affecting stock returns is an ongoing research area in the finance literature. Determining the variables

affecting stock returns is the most important issue for investors and portfolio managers (Güler et al., 2011). One of the most important indicators showing the development level of countries and the living standards of the society is the amount of energy consumption (Huseynli, 2024). In fact, in the study conducted by Huseynli (2023b) in 2023, it was determined that there was a significant relationship between energy consumption and commercial service exports at a probability level of 5%. In other words, it was concluded that a 1% increase in energy consumption explains approximately 27% of the commercial service exports of the Italian economy.

Oil prices are one of the most important factors affecting world and country economies. The degree to which oil prices affect the country's economy varies between oil-exporting and oil-importing countries. Oil is one of the most important sources of income for oil-exporting countries, and therefore, an increase in oil prices will create income for these countries and affect their economies positively, whereas a decrease in oil prices will negatively affect the country's economy as it will create income loss. In general, an increase in oil prices will reduce the national income of a country dependent on oil imports, while in the opposite case, an increase will occur.

Oil prices are one of the economic factors that greatly affect the financial markets of the countries and the stock prices in these markets, as well as the country's economies. Turkey, a developing country, imports oil and has financial markets that are sensitive to changes in oil prices. In this context, examining how oil prices affect stock prices in the country provides guidance for investors, policy makers and other market actors. In this context, this analysis is also important to inform investors.

This study aims to examine the relationship between oil prices and BIST 100 index and BIST electricity index prices. In this context, a literature review on the subject was conducted, then the data and methods used, and the application results were stated, and the study was concluded with the conclusion section.

2. LITERATURE REVIEW

Many studies have been conducted in the literature between stock indices and macroeconomic factors, both nationally and internationally (Sadorsky, 1999; Faff and Brailsford, 1999; Arouri and Rault, 2010; Ratti and Hasan, 2013; Gürlevik and Gazel, 2020). Oil prices also have a large place among the macroeconomic factors in question. Especially in recent years, studies examining the effects of international oil prices, oil shocks and the risks created by oil prices on stock indices have increased.

Many studies in the literature show that oil prices are quite effective on various economic activities. Research reveals that there is a close relationship between oil price changes and macro economies, economic activities, and stock returns (Nandha and Faff, 2008).

Sadorsky (1999) analyzed the impact of oil prices and their fluctuations on stock returns in the United States from January 1947 to April 1996. Sadorsky's (1999) analysis indicates that fluctuations in oil prices influence economic activities, but variations in economic activities have little impact on oil prices. The analysis indicated that fluctuations in oil prices significantly influence stock returns, establishing a notable positive correlation between the two variables.

Faff and Brailsford (1999) investigated the correlation between stock returns and oil prices across 24 sectors in Australia from 1983 to 1996. The study's results revealed a considerable positive correlation between oil prices and both the oil and gas industry and diverse product sectors. A notable negative correlation was seen in the paper and packaging, transportation, and banking sectors, indicating that each sector lacks a homogenous structure and that the effect would vary across sectors.

Cong et al. (2008) investigated the interaction between oil price shocks and the Chinese stock market using monthly data for the period 1996-2007. Multi-factor VAR model was used, and, except for the manufacturing industry index and some oil companies, oil price shocks were significant in most Chinese stock indices. It was concluded that it had no effect.

Sadorsky (2001) revealed that share prices in the oil and gas industry in Canada between April 1983 and April 1999 were affected by exchange rates, crude oil prices and interest rates. According to Sadorsky (2001), the increase in oil prices also increases the prices of stocks in the oil and gas sector. The increase in interest rates causes the opposite effect.

In the study conducted by Arouri and Rault (2010), the relationship between oil prices and stock markets was investigated in the Gulf Arab Countries Cooperation Council countries using weekly data for the period June 2005-May 2010. As a result of the study, a two-way causality relationship was found between the stock market and oil prices in Saudi Arabia. In addition, oil price shocks in other countries are Granger causes of stock price changes; Findings have also been obtained that stock price changes are not the Granger cause of oil prices.

El-Sharif et al. (2005) investigated the correlation between crude oil prices and stock returns of firms in the oil and gas industry in the UK, the foremost oil producer in the European Union. El-Sharif et al. (2005) conducted a multi-factor study from January 1989 to June 2001, concluding that fluctuations in crude oil prices, capital markets, and currency rates significantly influenced stock returns. Their findings indicated that fluctuations in oil prices also elevated oil and gas stock returns in the UK.

In the study conducted by Broadstock et al. (2012), weekly data for the period of January 2000-May 2011 were used in the Chinese markets and the relationship between international oil prices and stock returns of companies belonging to the energy sector was examined. The result obtained from the study, which was conducted using time series correlation and VFM, was that the change in international oil prices affected the stock returns of companies belonging to the energy sector.

Henriques and Sadorsky (2008) looked at the oil price and the share prices of alternative energy businesses. They examined

335 weekly observations from the 2007 period and tested the relationship between alternative energy companies' share prices, technology companies' share prices, oil prices and interest rates using the VAR model. According to Henriques and Sadorsky's (2008) research, Granger causality test findings, changes in technology share prices are more effective on the share prices of alternative energy companies than oil prices.

Using daily data from March 2001 to December 2010, Ratti and Hasan (2013) investigated how oil shocks affected the returns and volatility of the Australian stock market. When all indices in the Australian stock market are examined in general, it is seen that the increase in oil price returns reduces stock returns, while the increase in oil return volatility significantly reduces stock return volatility. When the energy and materials sector and the finance sector are examined, it can be stated that the increase in oil prices increases the stock returns in the energy and materials sector, and the increase in oil price return volatility increases the stock return volatility in the finance sector.

The impact of volatility and shocks to the price of oil on stock returns in the US and 13 European nations was studied by Park and Ratti (2008). In their study, they examined stock prices, short-term interest rates, consumer prices and industrial production variables using the VAR model between January 1986 and December 2005. According to the findings of Park and Ratti (2008), shocks in oil prices have a significant impact on stock returns within the same month or during a month. Unlike other countries, there is a positive effect between oil prices and stock returns in Norway, and shocks in oil prices cause 6% variability in stock returns.

In order to examine the effects of oil price shocks on stock returns in 12 oil-importing European economies, the study by Cunado and Gracia (2014) was conducted by applying VAR and VECM models for the period February 1973-December 2011. According to the study's findings, actual stock returns' responses to oil price shocks differ based on the underlying reasons of these events, and stock returns in European economies are significantly impacted negatively by oil price shocks.

Nandha and Faff (2008) examined the data of 35 companies between April 1983 and September 2005 and tried to determine how the securities of these companies were affected by shocks in oil prices. The result obtained was that the change in oil prices had a negative effect on the stock returns of all sectors except mining and oil-gas sectors.

Chen (2009) examined the change in oil prices in the stock market for the period January 1957-May 2009 in America. Chen (2009) study investigated the effects of oil price shocks on bear and bull markets. According to the findings of the research, high oil prices increase the possibility of a transition from a bull market to a bear market.

In Turkey, the relationship between changes in world oil, coal and natural gas prices and the electricity index, which is an indicator of the return performance of electricity companies traded on the stock exchange, has been examined by some researchers. For example, Güler et al. (2011), Eryiğit (2009); Soytaş and Oran (2008); Abdioğlu and Değirmenci (2014); Vardar et al. (2018) in their study, the relationship between oil price movements and BIST electricity index; Gürlevik and Gazel (2020) examine the relationship between oil prices, electricity index and electricity prices; Ordu and Soytaş (2016) investigated the relationship between oil and natural gas prices and BIST electricity index.

Abdioğlu and Değirmenci (2014) investigated the effect of oil prices on sector indices using daily data for the period 2005-2013. Accordingly, they stated that there is no causal relationship between the BIST electricity index and oil prices.

Vardar et al. (2018) investigated the relationship between the fluctuation in oil prices and Borsa Istanbul sector indices, which they divided into four subgroups, using daily data for the period 1997-2016. There is no cointegration relationship between oil prices and the electricity sector index in the long run; However, they determined that changes in oil prices were the Granger cause of the electricity sector index.

In their study, Gürlevik and Gazel (2020) investigated the impact of electricity, natural gas and oil prices on the BIST Electricity index in the January 2010-January 2019 period using the asymmetric ARDL (NARDL) method. As a result of the analysis, there is a negative and significant relationship between the BIST electricity index and gas prices in the long term; However, they determined that there is no significant relationship between electricity prices and oil prices in the long term. According to the short-term estimation results, the researchers stated that the relationship between the electricity index and oil prices is positive, however, the direction of the relationship with gas varies depending on the delays.

İşcan (2010) investigated the long-term relationship between oil prices and stock prices using daily data for the period 2001-2009. As a result of this study, which applied the Ganger causality test and the Johansen-Juselus cointegration test, no relationship was found between oil prices and stock prices. A similar method was used in the study applied by Huseynli (2023a) on Azerbaijan, and the result obtained was that there was a bidirectional causality relationship between economic growth and foreign investments in this country.

Şener et al. (2013) examined the relationship between Borsa Istanbul closing prices and oil prices using daily data for the period 2002-2012, using latent cointegration tests developed by Granger and Yoon (2002) and Hatemi-J and Irandoust (2012). As a result of the study, findings were obtained that increases or decreases in oil prices are effective in the formation of stock prices.

Soytaş and Oran (2008) investigated how fluctuations in world oil prices were reflected in the ISE electricity index. In their study, the impact of world spot markets on the foreign exchange market and the shares of energy companies traded on the ISE between May 2003 and March 2007 was examined. In their studies, the expected effects on oil prices and exchange rates were not observed.

Öztürk et al. (2013), the relationship between oil and natural gas prices and the ISE manufacturing sector and chemical-petroleum-plastic sector indices was examined for the period January 1997-December 2009. In the study where traditional and broken unit root tests and cointegration analyzes were used, tests that took breaks into account showed that there was cointegration between oil and natural gas prices and the ISE manufacturing sector and chemical-oil-plastic sector indices, while traditional tests could not detect any relationship between the variables in question.

3. RESEARCH METHODOLOGY AND DATA

3.1. Data Set

The data used in the study refers to 7521 weekly price levels belonging to the time period June 19, 2014-June 19, 2024. Data for all three variables were obtained from the investing.com platform. BIST 100 and BIST electricity index values are obtained in Turkish Lira (TL). The values of oil prices are calculated in TL by multiplying them with the daily USD Dollar/Turkish Lira exchange rate obtained from the CBRT electronic data distribution system.

3.2. Analysis Method

In the modern era, we are going through a period where there are millions of data and large-scale time series are also applied (Bahadori and Liu, 2012; Verbeek, 2008). Such large data sets are analyzed using different econometric models. One of these econometric methods is Granger causality analysis. This method is a statistical method used to investigate the flow of information between time series (Granger, 1969). According to this method, if the past values of variable x help to predict the future values of y, then this means that variable x is also a cause of variable y.

The Granger method has some important aspects. In fact, this method is the proposal to use estimation (and especially tools from learning theory) to measure the amount of information exchanged by two (sub) systems. In addition, it is known that another benefit is that a self-organization measure based on optimal predictors has recently been proposed (Geweke, 1982; 1984). However, it should not be forgotten that in the Granger method, only the past values of 1 time series should help predict the other, so that it can be accepted as the cause of the time series (Bahadori and Liu, 2012).

In order to base judgments in the domains of energy and the economy on sound scientific principles, econometric studies are crucial. Policymakers may use these studies to establish strategies that will promote sustainable energy policies and economic development. Furthermore, econometric research offers direction on matters like calculating the energy supply-demand balance and quantifying the impact of energy market volatility. In order to improve the efficiency of economy and energy policy, econometric techniques become a crucial instrument. For this study, our research in this area has also produced experience (Akbulaev et al., 2020; Huseynli, 2023, 2022).

4. RESULTS

Before establishing the model for the study, the necessary variables were discussed. As explained in the theoretical framework, BIST 100, BIST electricity index and oil prices constitute the main factors of this study. Function variables for the model are included in Equation 1.

$$Y = f(BIST100,\ BIST\ electricity,\ oil\ price) \quad (1)$$

The models established for the study are included in Equations 2-4. All three variables in the model are considered as dependent and independent in order to obtain a more solid causality result.

$$BIST100 = \beta 0 + \beta 1 BISTelectricity + \beta 2 oil\ price \quad (2)$$

Figure 1: Daily values based on the BIST 100 index

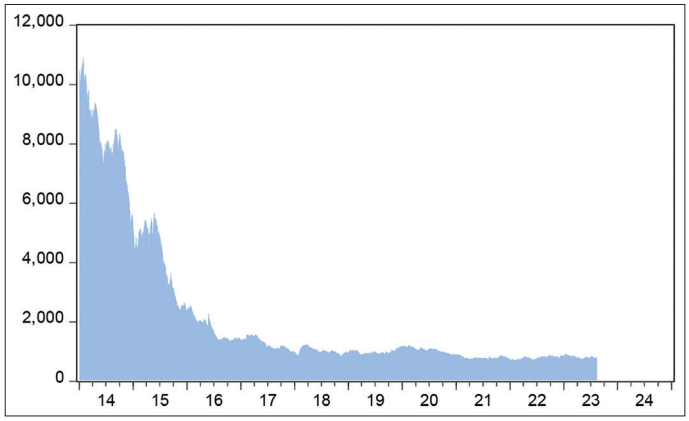


Figure 2: Electricity index traded on the ISE

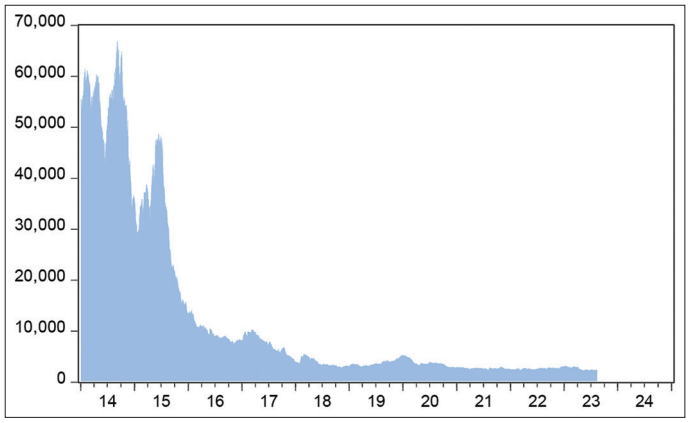
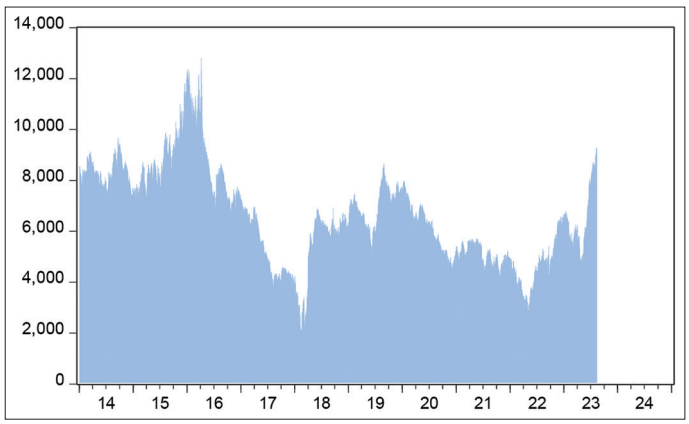


Figure 3: Oil prices



$$BISTelectricity = \beta 0 + \beta 1BIST100 + \beta 2oil\ price \quad (3)$$

$$Oil\ price = \beta 0 + \beta 1BIST100 + \beta 2BISTelectricity \quad (4)$$

After the models were established, the price changes of the data over time were discussed graphically. When we analyze Figures 1-3, it is seen that the prices of the variables are volatile in the last 10 years. It seems that oil prices, which are an international product and important for the whole world, have a lot of dynamism. It is undeniable that the Covid-19 pandemic, as well as the economic and political crises experienced in the last 10 years, had a significant impact on these price fluctuations.

Although the changes in BIST 100 and BIST electricity index have also been present over the years, they have remained more stable compared to oil prices since 2016, due to the similarity in the growth of the Turkish economy, its political position, or its power in attracting foreign investors being almost the same.

It is possible to observe the changes of the series over time in the graphs of the time series variables used in the analysis. Daily values based on the BIST 100 index are shown in Figure 1. When the charts created with daily data of the BIST 100 index are examined carefully, a structure with many ups and downs is encountered. In the data examined graphically, a slowing down trend that started after mid-2016 is observed. Visually, trends appear to be a little more difficult to identify on a chart. It becomes a little more difficult to determine whether the series is stationary or not and to visually detect the presence of a unit root.

The time chart of the electricity index traded on the ISE was prepared with the same approach (Figure 2). When the graphs created with daily data of the electricity index are examined carefully, a structure with many ups and downs is encountered. In the data examined graphically, a slowing down trend that started after mid-2016 is observed. Visually, trends appear to be a little more difficult to identify on a chart. It becomes a little more difficult to determine whether the series is stationary or not and to visually detect the presence of a unit root.

When we examine the graph of oil prices, it is possible to actively see the volatility in prices. When we look at the latest updated tariffs, we see that prices are in a serious increasing trend.

Before conducting a causality analysis, it is necessary to confirm whether the relationship between variables is compatible with causality. For this, a series of assumption tests are needed. Generally speaking, it is known that time series are not stationary in their level values. If regression analysis is applied to non-stationary data, this situation causes fake or misleading regression results to be obtained. In fact, despite obtaining a high coefficient of determination (R^2), a low Durbin-Watson statistic is obtained as a result. As a result of such a regression, the error terms are not stationary and although the result of the regression equation shows high reliability, it is actually unreliable (Matthews, 2010).

The non-stationarity of the data set to be used in the analysis may be due to different reasons. If this situation is due to the series in question containing a deterministic time trend, it is easy to eliminate this situation. However, if the data set contains a random trend, it is necessary to make these series stationary and the difference is continued until stationarity is obtained. The number of times the difference should be taken until such a series becomes stationary is called the degree of integration.

When the ADF test is applied on the variables in this study, it appears that BIST 100 and BIST electricity index are stationary at their level. The fact that oil prices are not stationary at some level made it possible to make the data stationary. As a result of the first-order stationarity test, oil prices became stationary. Level and 1st stationarity results for the data set are given in Table 1.

After the stationarity of the series was tested, the appropriate lag length was determined. AIC and SC values were taken as basis in determining the appropriate delay length. Data on appropriate delay length are in Table 2.

After the hypothesis testing tests were performed, Granger causality analysis was carried out. As can be seen from the Granger

Table 1: Stationarity values

Stationarity values from level order						
Statistical values	**BIST 100**		**Electricity index**		**Oil price**	
	t-statistics	**Significance value**	**t-statistics**	**Possibility**	**t-statistics**	**Significance value**
ADF testing statistics	−4.894793	0.0000	−3.193785	0.0014	−2.042363	0.2687
Test critical values %						
1	−3.432789		−2.565889		−3.432766	
5	−2.862503		−1.940951		−2.862493	
10	−2.567328		−1.616614		−2.567322	
First order stationarity value						
Oil price						
Statistical values	**t-statistics**				**Significance value**	
ADF testing statistics	−50.18213				0.0001	
Test critical values						
1	−3.432767					
5	−2.862494					
10	−2.567323					

Table 2: Appropriate delay length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−68327.67	NA	1.18e+20	54.73021	54.73720	54.73275
1	−47724.01	41141.30	8.09e+12	38.23469	38.26267*	38.24485
2	−47696.19	55.48453	7.96e+12	38.21961	38.26858	38.23739
3	−47685.07	22.14293	7.95e+12	38.21792	38.28788	38.24332
4	−47669.66	30.66418	7.91e+12	38.21278	38.30373	38.24580
5	−47633.54	71.77892	7.74e+12	38.19106	38.30299	38.23170
6	−47607.22	52.22906	7.63e+12	38.17719	38.31011	38.22545*
7	−47595.64	22.96875	7.62e+12	38.17512	38.32903	38.23100
8	−47580.17	30.62038	7.58e+12	38.16994	38.34484	38.23344
9	−47575.38	9.474521	7.60e+12	38.17331	38.36920	38.24443
10	−47560.23	29.92267*	7.57e+12*	38.16839*	38.38526	38.24713

*Indicates the appropriate lag length for the relevant test

Table 3: Results of Granger causality test

Hypotheses	F-value	Significance value (P)	Decision at 1% significance level
Changes in the electricity index are the reason for changes in oil prices.	1.869869	0.3926	Rejected
Changes in BIST 100 index are the reason for changes in oil prices.	1.847865	0.3970	Rejected
Changes in oil prices are the reason for changes in the electricity index.	0.562561	0.7548	Rejected
Changes in the BIST 100 index are the reason for the changes in the electricity index.	52.65990	0.0000	Acceptable
Changes in oil prices are the reason for changes in the BIST 100 index.	0.014191	0.9929	Rejected
Changes in the electricity index are the reason for the changes in the BIST 100 index.	34.69926	0.0000	Acceptable

causality test results, the H_0 hypothesis is accepted only in the hypotheses in the 4th and 6th lines. In our other hypotheses, H_0 is not accepted because the significance values are >0.05. According to the results of the analysis made on the BIST 100, BIST electricity index and oil prices trilogy within the framework of Turkey, the changes in the BIST 100 index affect the price changes in the BIST electricity index. In short, there is a causality between these two variables. Similarly, there is a causality situation for the BIST electricity index towards the BIST 100 index. If there is a mutual causality situation between the two variables, this is known as the double-sided Granger effect. There is no significant effect between the other variables (Table 3).

5. DISCUSSION AND CONCLUSION

Examining how oil prices affect equities is also helpful for diversifying a portfolio. Investors may more successfully diversify their portfolio and strike a balance between several industries by understanding the link between oil and stock prices. Long-term, this may lower possible losses and provide more consistent profits. Compared to other studies in the literature, the lack of impact of oil prices on BIST 100 and electricity indices may indicate unique characteristics of the Turkish market, such as local economic conditions, regulatory environments, or investor behaviors that differ from the US or Australian contexts. Although this study focusing on Turkey did not find a significant relationship between oil prices and BIST 100 or electricity indices, the literature generally supports that oil prices have a strong impact on stock returns in various contexts. This inconsistency suggests that regional economic conditions or structural market differences may explain the lack of impact of oil prices in Turkey.

This study's findings of bidirectional causality between BIST 100 and electricity indices are distinct from many other studies that show unidirectional causality from oil prices to stock returns. For example, Abdioğlu and Değirmenci (2014) also failed to find a causal relationship between BIST electricity index and oil prices, which is consistent with our study's results and suggests a common understanding of the dynamics of the Turkish market. This contradicts many studies that show a unidirectional causality from oil prices to stock returns, as seen in the study by Arouri and Rault (2010). This suggests a potentially unique interaction between these particular indices in Turkey that may not be present in other contexts. In contrast, studies by Sadorsky (1999) and Faff and Brailsford (1999) highlight the importance of oil prices in affecting stock returns and economic activity, and in many cases find positive correlations. This suggests that oil prices are often viewed as the primary drivers of market dynamics. Our study's findings are in conflict with those of Ratti and Hasan (2013), who found that rising oil prices had a beneficial impact on the energy and materials sectors. These findings imply that the industries included in BIST 100 could be less susceptible to changes in oil prices.

The literature frequently discusses both the short-term and long-term effects of oil price shocks on stock markets. For example, Cunado and Gracia (2014) emphasized the complexity of these relationships by stating that the impact of oil price shocks varies depending on the underlying causes. Our study, which focuses on a specific period, may capture short-term dynamics that do not reflect the long-term relationships reported in other studies. It should be noted that the time frame and methodologies used in the studies in the literature may also lead to different results. For example, the Turkey study focuses on daily data over a 10-year period, while other studies use various time frames and data frequencies that may affect the observed relationships.

In conclusion, while the broader literature supports the strong impact of oil prices on stock market performance, the findings from the BIST 100 analysis suggest that local market dynamics may lead to different relationships. This highlights the importance of considering context-specific factors when interpreting the effects of oil prices on stock market indices.

In this study, Granger causality analysis was carried out by considering the daily price levels of the BIST 100 index, oil prices and electricity index in the time period of June 19, 2014-June 19, 2024. According to the analysis, the following results were obtained: BIST100 index and electricity index show similar behavior in the determined period. It has been observed that the values move in a similar downward direction, especially after 2016. The ISE electricity index and BIST 100 index price variations are not due to changes in brand oil prices. Conversely, there is a two-way causal relationship between the BIST electricity index and the BIST 100 index.

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