PETROL FİYATLARI VE BIST100 HİSSE SENEDİ GETİRİSİ İLİŞKİSİ

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ÖZ

Bu çalışma, 1986: 01 - 2016: 02 döneminde petrol fiyatları ile BIST100 Endeksi hisse senedi getirileri arasındaki ilişkinin incelenmesi amacı ile yapılmıştır. Çalışmada zaman serileri kullanılmıştır. Analizler sonucunda petrol fiyatları ile BIST100 hisse senedi getirileri arasında negatif ilişki olduğu tespit edilmiştir. Yani petrol fiyatları arttıkça, hisse senedi getirileri azalmaktadır. Ayrıca yapılan nedensellik analizi sonucunda hisse senedi getirisinden petrol fiyatlarına doğru tek yönlü nedensellik tespit edilirken, petrol fiyatlarından hisse senedi getirisine doğru nedensellik tespit edilememiştir.

Anahtar Kelimeler: Petrol Fiyatları, BIST100 Hisse Senedi Getirisi, Eş-Bütünleşme

THE RELATIONSHIP BETWEEN OIL PRICES AND BIST100 STOCK RETURNS

ABSTRACT

This study was conducted with the aim of examining the relationship between oil prices and BIST100 Index stock returns during 1986: 01 - 2016: 02 period. Time series were used in the study. As a result of the analyses, it was determined that there is a negative relationship between oil prices and BIST100 stock returns. That is, as oil prices increase, stock returns decrease. In addition, as a result of the causality analysis, causality from oil prices to stock returns was not determined while one-way causality from stock returns to oil prices was determined.

Keywords: Oil Prices, BIST100 Stock Returns, Cointegration

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1. INTRODUCTION

Oil, which has been gaining more and more value since 1970s, is emerging as the lifeblood of economies. Especially, social and technological modernization of countries has increased their demand for oil. Of course, it is difficult to estimate the future demand for oil, but today the association between industrial development and oil is a reality that cannot be ignored. Significant involvement of the oil in socio-economic life has, no doubt, affected financial markets where people utilize their savings.

Since Hamilton (1983), which argues that oil could have an impact on economic fluctuations, the relationship between oil prices and macroeconomic variables has become an important research topic. As the transmission mechanism of the shocks in the market economy has emerged through price changes, the significant increases and decreases in oil prices have led to an increase in interest in this issue. The potential that oil price shocks are likely to affect the real economy, emerges the possibility of the reflection of the effects on financial markets. Therefore, a literature focusing on the relationship between oil prices and stock market performance has been formed.

Accordingly, the purpose of our work is to examine the relationship between oil prices and stock returns in Turkey between January 1986 and February 2016 and to give this area richness in literature. For the purpose, this relationship was examined using time series and results were reported.

Despite research done around the world focusing on the relationship between oil and stock returns, in Turkey, most of the studies have included oil prices in the macroeconomic variables while examining their effects on stock returns. We have not come across a single study investigating solely the relation between oil prices and stock returns in Turkey. In this context, results obtained in this research are expected to be instructive for future research.

2. LITERATURE

When literature is examined, it is seen that the studies on the relation between oil and microeconomic variables accelerated after the 1970s, and the first studies on this area were made by Pierce and Enzler (1974), Rasche and Tatom (1977) and Draby (1982). Further work was done by Hickman et al. (1987), Jones and Leiby (1996), Hooker (1999), Hammes and Wills (2003) and Leigh et al. (2003).

On the other hand, the relationship between oil prices and financial markets is seen to be a less-studied area, on which studies have been delayed. The first work on this field is the study by Jones and Kaul (1992) that shows the relationship between stock prices and oil prices. Following this study, Jones and Kaul (1996) also conducted a study of the relationship between stock market and oil price fluctuations. After Jones and Kaul's work, the researches gained momentum, and researchers such as Haung et al. (1996), Gjerde and Saettem (1999) and Sadorsky (1999) also conducted studies on this field. While no relation was found in some of the studies related to oil prices and stock returns, in many studies, the relationship between these two variables was determined and this relationship was found positive in some studies and negative in others. Some of the work done in this area is summarized below:

Kaneko and Lee (1995) have reached the conclusion that oil prices are not influencing stock returns, in their study using Japanese stock market data. Arouri et al. (2011), in their study of the Gulf States (Qatar, the United Arab Emirates and Saudi Arabia) during the 2005:M6-2008:M10 period, have found a positive impact

in the short term. In any Gulf country, except Bahrain, there was no correlation between long-term oil prices and stocks. Bittlingmayer (2006) found that the rise in oil prices caused by the risk of war following the oil crisis of 1973 and 1979 led to serious decreases in stock markets and high increases in treasury bill returns.

Narayan and Narayan (2010) examined the relationship between oil prices and stock prices in Vietnam using the Johansen cointegration test in the period 2000-2008. As a result of the study, they found that there is a long and positive relationship between oil prices and stock prices.

Malliaris and Urrutia (1995) found that the increase in oil prices during the Gulf Crisis caused significant decreases in stock prices as well as affecting economic activity. Sadorsky (1999) found that the change in crude oil prices is the most important determinant of stock market returns and concluded that the stock market exhibits negative behavior against the increase in crude oil prices.

Le and Chang (2011) investigated the volatility of oil market price fluctuations in Japan, Singapore, South Korea and Malaysia with the monthly data for the January 1986-February 2011 period. Against the changes in oil prices, the stock market was positive in Japan and negative in Malaysia, while the reaction in Singapore and South Korea was unclear.

Research conducted in Turkey on the relation between oil prices and stock returns is much less than other countries. İşcan (2010) explored the long-term relationship between oil prices and stock prices with the daily data of İstanbul Stock Exchange BIST100 index. The author found that there was no relationship between oil prices and stock prices.

Kılıç et al. (2013) analyzed the relationship between the İstanbul Stock Exchange industrial price index and crude oil prices using the Gregory-Hansen cointegration test, dynamic least squares approach in the period 1994: 01 - 2013: 10. The study concluded that there is a long-run relationship between crude oil prices and the industrial price index, and that the increase in crude oil prices has increased the industrial price index. Akgün et al. (2013) examined the effect of changes in gold and oil prices on BIST 100 using the Johansen cointegration test from January 2000 to April 2013. They found that there is a positive correlation between the BIST 100 index and oil prices.

3. DATA SET AND METHODOLOGY

Table 1: Summary of Data

Variables	Variables' Code	Location of Data
Brent Oil Prices_SA	P	US Department of Energy
BIST100 Stock Returns_SA	B	İstanbul Stock Exchange

The variables in Table 1 belong to the period 1981: 01-2016: 02 and the variables were removed from the seasonal effects with Census-12 included in the Eviews 9 package program and the relationship between BIST100 stock returns and Brent oil prices was examined using Eviews 9 with the following analyses.

3.1. ADF Unit Root Test

When working with non-stationary series in the time series, the results will not reflect the truth or reflect it inaccurately. In this context, unit root tests such as the Dickey-Fuller Test (DF), the Augmented Dickey-Fuller Test (ADF), the Phillips-Perron (PP) and the Kwiatowski-Phillips-Schmidt-Shin (KPSS) have been developed with the aim of eliminating the stagnation problem in the time series. In our study, unit root test developed by Dickey-Fuller (1979) and Phillips-Perron (PP) test were used and stagnation of the series was examined by ADF and PP test.

The equations related to the **Augmented Dickey-Fuller Test (ADF)** are explained below:

$$Y_t = Y_{t-1}+u_t \quad (1)$$

In the equation, if coefficient of Y_{t-1} is equal to 1, there is a serial unit root problem, that is, the series is not stationary. In other words, because there is a relation between Y_t and Y_{t-1}, the series is not stationary.

$$Y_t = pY_{t-1} +u_t \quad (2)$$

According to the equation above, if p=1, there is a unit root in the series, that is, the series is stationary.

Phillips-Perron (PP) extended this assumption about Dickey-Fuller's error terms:

$$Y_t= a_0+ a_1y_{t-1} +u_t \quad (3)$$

$$Y_t= a_0+ a_1y_{t-1}+a_2*(t-T/2) +u \quad (4)$$

Where T is the number of observations, μ is the distribution of error terms, and the expected mean of these error terms is equal to zero.

3.2. Johansen-Juselius Cointegration Analysis

The cointegration analysis is an analytical method that observes long-term relationship between series and is performed in two ways. The first is the trace statistic and the other is the highest (max.) eigenvalue. According to this, when the trace statistic value and the highest eigenvalue statistic are bigger than the Mac Kinnon (1999) threshold values, it is accepted that there is a long-run relationship between the series and the H_0 hypothesis is rejected.

The analysis, developed by Johansen-Juselius (1990), predicts that if there are two variables in a model, there will be more than one cointegrator. In other words, they stated that there may be more than one equilibrium relationship in a model. It can be simply expressed as:

$$Y_t = a_0+ a_1X_t + \varepsilon_{1t} \quad (5)$$

$$Y_t = a_0+ a_1X_t + \varepsilon_{2t} \quad (6)$$

It is expected that the error terms obtained from equations 1 and 2 are stationary in order to be able to cointegrate. The following equations are predicted for such situation:

$$\Delta u_{1t} = \beta_1 u_{1t-1} + \sum_{i=1}^{p} a_{1i}\Delta u_{1t-1} \varepsilon_{1t} \quad (7)$$

$$\Delta u_{2t} = \beta_1 u_{2t-1} + \sum_{i=1}^{p} a_{1i}\Delta u_{2t-1} \varepsilon_{2t} \quad (8)$$

Here, if $\Delta = 0$, there is no cointegration between variables, otherwise means cointegration between variables.

3.3. Error Correction Model

With the Error Correction Model, it is examined whether the long-term shocks of the series are temporary or not and how long the shocks are going to occur. (Yıldırtan, 2011:248).

$$Y_t = \beta_0 + \beta_1 X_t + u_t \quad (9)$$

Error Correction Model is obtained by adding a lagged value of residuals obtained from equation 9, to the equation.

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \mu_{t-1} + \square_t \quad (10)$$

If α_2 is significant in the 10th equation, it explains how the imbalance in Y is corrected in the next period. On the other hand, it is expected that the value of μ_{t-1}, i.e. the error correction term, is negative. Negative error correction term implies that short term imbalance leads to long term equilibrium (Kıran, 2007: 273-274).

3.4. Granger Causality Analysis

In the analysis method developed by Angle-Granger (1987), it is stated that the causality relation can be examined after finding that the variables used for analysis are integrated in the first order.

$$X_t = \sum_{i=1}^{m} X_{t-i} + \sum_{i=1}^{m} b_j Y_{t-i} \varepsilon_1 \quad (11)$$

$$Y_t = \sum_{i=1}^{m} C_{j-i} X_{t-j} + \sum_{i=1}^{m} b_j Y_{t-i} \varepsilon_2 \quad (12)$$

It is assumed that X_t and Y_t variables are stationary at the same level and have zero average, ε_1 and ε_2 error terms are not autocorrelated. Within this context, when B_j values in the first equation are different from zero, Y_t is the Granger reason of X_t. In the same way, if C_j values are different from zero, X_t is the Granger reason of Y_t is If both of these conditions are present, there is a two-way causality between X_t and Y_t is If B_j and C_j are not different from zero, it can be said that there is no causality between X_t and Y_t.

4. FINDINGS

4.1. Investigation of Stationarity of the Series

ADF Unit root test results related to examination of steadiness of the series are reported in Table 2.

Table 2: ADF Unit Root Test Results

Variables		Level Values		First Difference Values	
		With Constant	With Constant / With Trend	With Constant	With Constant/ With Trend
B		-1.87 (0.34)	-2.98 (0.15)	-18.32[(a)] (0.00)	-18.30[(a)] (0.00)
P		-2.15 (0.22)	-2.48 (0.33)	-11.79[(a)] (0.00)	-11.79[(a)] (0.00)
Critical Values	%1	-3,44	-3,98	-3,44	-3,98
	%5	-2,86	-3,42	-2,86	-3,42
	%10	-2,57	-3,13	-2,57	-3,13
(a) shows that series are stationary at %1 significance level					

Table 2 shows that both series are not statistically stationary at both 1%, 5% and 10% significance levels at both fixed and fixed/trending levels. After the first difference of the series was taken, both series became stationary statistically at %1 significance level at both value with constant and value with trend.

Table 3: PP Unit Root Test Results

Variables		Level Values		First Difference Values	
		With Constant	With Constant / With Trend	With Constant	With Constant / With Trend
B		-2.05 (0.26)	-3.49[(b)] (0.04)	-18.38[(a)] (0.00)	-18.36[(a)] (0.00)
P		-1.85 (0.35)	-2.42 (0.36)	-11.54[(a)] (0.00)	-11.53[(a)] (0.00)
Critical Values	%1	-3,44	-3,98	-3,44	-3,98
	%5	-2,86	-3,42	-2,86	-3,42
	%10	-2,57	-3,13	-2,57	-3,13
(a) and (b) show that series are stationary at %1 and 5% significance levels respectively					

According to PP unit root test results in Table 3, while B series is not statistically stationary at the value with constant, it has become statistically stationary at 5% significance level at the values with constant/with trend. P series is not statistically stationary at both values with constant and with constant/with trend. After the first differences of both series were taken, they became statistically stationary at 1% significance level at values with constant and with constant/with trend.

4.2. Determination of Appropriate Lag Length

Results of analysis carried out in order to find suitable lag length are reported in Table 4.

Table 4: Appropriate Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3216.461	NA	284689.0	18.23491	18.25681	18.24362
1	-3169.287	93.54590	222914.2*	17.99030*	18.05601*	18.01645*
2	-3166.824	4.857347	224863.8	17.99900	18.10853	18.04258
3	-3165.836	1.936590	228735.7	18.01607	18.16941	18.07708
4	-3162.718	6.076422	229884.7	18.02107	18.21822	18.09952
5	-3159.484	6.265985	230889.1	18.02541	18.26638	18.12129
6	-3156.536	5.679545	232275.0	18.03136	18.31615	18.14468
7	-3147.558	17.19201*	225824.2	18.00316	18.33176	18.13392
8	-3146.007	2.952625	228990.1	18.01704	18.38945	18.16522

LR: Likelihood Ratio **FPE**: Final Prediction Error **AIC**: Akaike Information Criteria
SC: Schwarz Information Criteria **HQ**: Hannan Quinn

According to Table 4; FPE, AIC, SC and HQ Information Criteria indicate the first lag. The LR Criteria point to the seventh lag. However, since reliability of SC and AIC Criteria is higher, the first lag is determined as the appropriate lag length.

4.3. Investigation of Long Term Relationship

The long term relationship of the series was tested by Johansen-Juselius Cointegration Analysis and the results are reported in Table 5.

Table 5: Johansen-Juselius Cointegration Test Results

Variables	**Hypothesis (H_0)**	**Maximum Eigenvalue Statistics**			**Path Statistics**		
		Statistics	%5 Critical Value	Probability	Statistics	%5 Critical Value	Probability
P	r = 0*	142.58	11.22	0.000	222.88	11.22	0.00
B	r ≤ 1	80.30	4.12	0.000	80.30	4.12	0.00

The hypothesis that "there is no cointegration between the variables (H_0: r = 0)" is rejected because the maximum Eigenvalue statistic and the path statistic values are greater than the critical values at the 5% significance level. According to this result, it is possible to say that there is at least one cointegrated vector among the series. In terms of path statistic and maximum Eigenvalue statistic, the test results indicate that there is a maximum of 1 cointegrated vector. As a result, it is observed that there is a cointegration relation between the analyzed variables, that is, the series move together in the long term.

B = -17.21875 (P) + C

According to the above equation, there is a statistically negative relationship between Brent oil prices and stock returns. In other words, one unit increase in the Brent oil prices leads to a decrease of 17.21875 units in BIST100 index stock returns.

4.4. Creating the Error Correction Model

Because of the cointegration between the variables, the model needs to be corrected for the long term. The Error Correction Model created in this context is reported in Table 6.

Table 6: Error Correction Mechanism

Variable	Coefficient	Standard Error	t-statistic	Probability
B	-0.135	0.055	-2.448	0.014
P	-8.212	1.819	-4.513	0.000
C	0.498	7.326	0.068	0.945
Coniteq*	-0.756	0.07	-10.15	0.000
R^2: 0.44 Corrected R^2: 0.45 F-Statistics: 95.95 Durbin-Watson: 2.065				

In the Error Correction Model, the error coefficient (coniteq) is negative (-0.756) and statistically significant (0.05> 0.000), indicating that there is a long-term relationship between the variables (Çetinkaya ve Türk, 2014: 55). In this context, it is seen that there is a long-run relationship between the variables and that short-term problems are corrected at approximately 0.756 in the long run. Moreover, the fact that the Durbin-Watson coefficient is greater than the corrected R^2 also removes the fake regression problem.

4.5. Causality Analysis Results

Causality between the series was tested by Granger Causality Analysis and is reported in Table 7.

Table 7: Granger Causality Analysis

Dependent Variable	Independent Variable	Chi-sq.	Probability
B	**P**	11.76	0.0006*
P	**B**	1.460	0.2259
* shows that there is causality at 1% significance level.			

As a result of the causality analysis, one-way causality from BIST 100 stock returns towards Brent oil prices was determined at 1% significance level. In other words, changes in stock prices affect oil prices. On the other hand, no statistical causality was found at the 1%, 5% and 10% significance levels from Brent oil prices to BIST100 stock returns.

5. CONCLUSION AND SUGGESTIONS FO FUTURE RESEARCH

Oil-exporting Arab countries announced in 1973 that they would not export oil to the countries standing beside Israel in the Yom Kippur War, at the same time OPEC increased oil prices, and as a result the oil crisis began. The rise in oil prices has caused economies and stock markets of the countries whose industries depend largely on oil and petroleum products, to suffer large losses. Such case displayed how an invaluable resource oil is. Although alternative energy sources are emerging today, oil and its derivatives are still among the most important factors that have an impact on the countries' economies. Because of this, oil has maintained its importance in the literature and especially its relation with different variables has been frequently studied by finance and economics researchers around the world.

In this context, we used the data of 1986: 01-2016: 02 period in our study of the relationship between BIST100 stock returns and Brent oil

prices. First of all, we cleared the series from seasonal effects. Afterwards, we examined stationarity in the series and stabilized them by ADF Unit Root Test and PP Unit Root Test. We then selected the appropriate lag length and examined the long term relationship between the series using the Johansen-Julius Test. Then, we created the Error Correction Model and lastly the examined the causality relation between the series.

As a result of the analyses conducted, we determined that there is a long-term relation between Brent oil prices and BIST100 stock returns, similar to some researcheRs such as Narayan and Narayan (2009), Güler et al. (2010), Adamarola (2012), Chittedi (2012), Şener et al. (2013), Kılıç et al. (2014) and Zortuk and Bayrak (2016) and contrary to some researchers such as Maghyereh (2004), Al-Fayoumi (2009), İşcan (2010) and Huang et al. (1996). And we saw that the relation is negative as some researchers such as (Faff and Brailsford, 1999; Sadorsky, 1999; Chen and Hsu, 2012; Adaramola, 2012; Odusami, 2012) found on the contrary to researchers such as (Ono, 2011; Ünlü and Topçu, 2012 Abhyankaret et al., 2013). As a result of the Granger Causality Analysis carried out on the other hand, we have found one-way causality towards oil prices from BIST100 stock returns, similar to the findings of researchers such as Kapusuzoğlu (2011), Abdioğlu and Değirmenci (2014).

Results of the study revealed that shocks in oil prices, one of the cornerstones of the modern economy, have been influential also on the stock markets of both developed and developing countries. Changes in oil prices seem to have an indirect effect on stock prices due to the effects of changes in oil prices on interest rates, industrial production index and GDP which are determined as macroeconomic variables, as well as the effect of the increase in oil prices directly on stock prices. In this context, regulatory and supervisory authorities should develop policies and set targets for developing the stock market and increase its contribution to economic growth.

This study was conducted with limited data and variables from BIST100 Index. Future research might expand the sample and use BIST Industry Index or BIST All Index for more accurate results of Turkey. In addition, the sample might be divided into sectors according to SIC (Standard Industrial Classification) codes. Researchers may also increase the number of countries and compare Turkey with other developing and developed countries in order to obtain more general results.

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