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EFFECTS OF OIL PRICE ON TURKISH STOCK MARKET

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EFFECTS OF OIL PRICE ON TURKISH STOCK MARKET
PETROL FİYATININ TÜRKİYE HİSSE SENEDİ PAZARINA ETKİSİ

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ABSTRACT

The price of oil is one of the most important macroeconomic factors that can influence the countries' economies. Because oil is the main source of energy for most countries, any fluctuation in the price of oil can affect companies' profits and hence their stock price. This study investigates oil price's effect on the Turkish Stock Market. After determining that there is cointegration among the variables, Vector Error Correction Model is used to study this relationship. The results suggest that in the long run, increasing oil price has a significantly positive impact on the Turkish Stock Market. The Granger Causality test is also run to check possible short-run impact of oil price on the Turkish Stock Market, but the Granger Causality results suggest that oil price does not have a significant effect on the Turkish Stock Market in the short-run.

Key Words: Crude Oil Price, Stock Price, Cointegration, Vector Error Correction
Model Granger Causality,

OZET

Petrol fiyatları  lkelerin ekonomilerini etkileyen en  nemli makroekonomik fakt rlerden biridir. Petrol n temel enerji kaynađı olması sebebiyle, petrol fiyatlarındaki dalgalanmalar řirketlerin karlılıklarını ve dolayısıyla hisse senedi fiyatlarını da etkileyebilmektedir. Bu  alıřmada petrol fiyatlarının T rkiye Borsası  zerindeki etkisi incelenecektir.  alıřmada kullanılan deđiřkenler arasında eřb t nleřmenin var olduđunun belirlenmesi  zerine,  alıřmada Hata D zeltme Modeli uygulanmıřtır. Model sonu larına g re petrol fiyatlarının T rkiye Borsası  zerinde anlamlı ve pozitif etkisi vardır.  alıřmada ayrıca kısa d nem iliřkiyi test etmek adına Granger Nedensellik testi de uygulanmıřtır. Bu test sonu larında ise petrol fiyatlarının T rkiye Borsası  zerindeki etkisinin kısa d nemde anlamlı olmadıđı sonucuna ulařılmıřtır.

Anahtar Kelimeler: Ham Petrol Fiyatı, Hisse Senedi Fiyatı, Eřb t nleřme, Hata D zeltme Modeli, Granger Nedensellik,

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LIST OF ABBREVIATIONS

API	American Petroleum Industry
WTI	West Texas Intermediate
OPEC	Organization of the Petroleum Exporting Countries
TPC	Turkish Petroleum Corporation
WAG	CO₂ / Water- Sequential-Gas Injection
OTC	Over the Counter market
MKK	Merkezi Kayıt Kuruluşu
CBRT	Central Bank of the Republic of Turkey
ADF	Augmented Dickey-Fuller
LR	Likelihood Ratio
FPE	Final Prediction Error
HQ	Hannan-Queen
SIC	Schwarz
AIC	Akaike
VECM	Vector error-correction model
BIST	BORSA ISTANBUL

INTRODUCTION

Since capital movements among markets have got easier as a result of the development of information technologies, it has increased the interaction between cross markets and varieties of economics tools and investment markets. The investors who go with the desire of high income have to know about the interaction among market relations and transfer mechanisms for hedging. So, it is expressed that energy supplement and climate change will not be casual scientific problems as long as habitability of the industrial society is in danger. In this point, it can be said that energy demand which has the power to influence social development has still been one of the most important agendas of countries' economics. In addition, it is possible to mention that oil which is the most important energy source has a serious impact on economic activities when considered it is the most traded commodity in the world.

Investors make their decisions about buying and selling in any market according to not only news around that market, but also other market's information they had. This situation which occurs as a result of increasing integration in money markets and revolution in free capital and commodity and informatics technologies is coherent with the active market hypothesis, as long as the news that is formed by international markets is related with the local assets/bonds prices. Investors' grasping the integration among stock certificate markets will provide a successful and effective work on hedging and trade strategies. Determining the interaction between oil prices and volatility and the stock dividend is helpful not only to avoid of risks but also to interpret and fix the reflections on the economics of countries that face oil industry problems. We have seen great increasing and decreasing oil prices in the last 40 years. When we consider that oil price has increased by 76 % between 2007 March and 2008 June and decreased by 48% between 2008 July and October, this change presents that it is important to research on how oil prices changing affects macroeconomics' values. To date, in some researches which have been done for various developing and developed countries, the impact of oil price changing on economic activities has been examined. In spite of these works that examine the impact of oil price changing on economic activities, it is quite rare to do research on the impact of oil price changing on stock certificate markets. Especially, since these works are intensified on a few industrial and Gulf Countries, it highlights the necessity of doing an analysis of this relation in developing countries as well. As it is different from the other studies, the purpose of this study is to research the impact of daily oil price changing on stock certificate

markets. The reasoning behind this research is the fact that the determinants of stock prices are important because the development of stock markets has an impact on economic growth.

In the second chapter of this study, oil is described, its history and feature are presented. In order to grasp why it is important so much, it should be known the oil first. Then the primary prices and drilling methods, import, and export beginning are mentioned. Examples, detailed charts and graphics are presented. The theoretical framework of oil price's effect on the economy and stock market, first organizations and groups are also mentioned in this part of the paper.

In the third chapter, subjects are considered in the scope of Turkey. The stock exchange market and oil market in Turkey are explained. Turkey's demand and supply of oil, Turkey's role in global oil market and the possible channels for the relationship between oil price and stock exchange are also mentioned in this part.

In the fourth chapter, descriptive statistics and the methodology of cointegration model which is run to investigate stock market oil price relationship are explained. The empirical results and their interpretation are given in the fifth chapter. The diagnostic tests for VECM results and the Granger Causality test based on VECM results are also presented in this part. The sixth chapter ends with conclusion.

1. OIL

This chapter will describe the oil and explore what kind of characteristics it has, and then will clarify how the oil price oscillated in the world, the elements which have influence in the prices and oscillate tools of macroeconomics. Consequently, there will be tables which present the literature review and it will be theoretically clarified between the energy consumption and financial development.

2.1. Oil, The Biography of Oil and Oil Reserves in The World

2.1.1. Description and Main Characteristics of Oil

The name oil has an antique origin indeed. It is also known as petrol which is short of "Petroleum". Petroleum is constituted with togetherness of the word "petra" and "oleum". "Petra" is Latin and means stone, and "oleum" is Greek and means oil.

Oil is a black, adhesive and burnable watery material and it comes out from lime and

sandstone underground, that's why they call it oil from the beginning. Its components are some hydrocarbons; butane, methane, ethane, and propane¹.

Oil has its structure from animals and plants on the ocean floors and bacteria in a fug area which underwent warmth and compression for millions of years. Oil is not a particular fuel defined as diesel, fuel oil or gasoline. However, it can be used to define the raw oil that is reached subterranean to the surface of the earth by nature. So, it is found between strata formed by aeriform hydrocarbons and saltwater strata that is more intense than the oil itself².

Since oil has a dangerous structure such as gravity, sulfur-containing, and consistency, it is classified to produce oil in the world. One of the keys to assorting of oil is the gravity explanation of API (American Petroleum Industry). To this explanation, density is inversely commensurate with the gravitational constant. Gravity increases and density decreases as a result, and this makes oil better quality. Taking account that gravity value is between 10 and 48, a formula was created to find the intensity of oil³:

$$(60F^{\circ}) \text{ The density of oil} = \frac{141,5}{131,5 + \text{the gravity of the oil}} \quad ()$$

Since it is not difficult to produce, transfer and prepare, low consistency oil type is favored in worldwide trade. In order to consider the oil as sulfur-free, it must be a maximum 0,5% level of sulfur.

2.1.2. The History of Oil

It was 3000 BC in Mesopotamia, people noticed the “bitumen” which is semi-solid and splashy material coming from the cracks. Those cracks are still known, for example, “Hit” is the famous one which is close to Babylon city in the Baghdad region. Bitumen was used in several areas and some of the knowns of them are for; Babylon and Jericho as wall cement, Noah's Ark as adhesive, Moses as a basket and for roads asphalt. Oil was used as both medicine and weapon, for example, while Americans managed alimentary issues, Greek and Romans had created the “Greek Fire” which had been used for centuries in wars.

¹ F. Parra, 2004. Oil politics: A modern history of petroleum. IB Tauris, p.78.

² .A. Schneider, 1983. Oil price revolution. Johns Hopkins University Press, United States, p.213

³ M. S., Masnadi, et al. 2018 Global carbon intensity of crude oil production. Science 361(6405), pp.851-853.

According to the study by Acar, Bulbul, Gumrah, Metin and Parlaktuna⁴ the first oil wells drilling was made to get salt through tying the bamboos by Chinese in the 4th century. This method was decided to be used in 1857 by the Pennsylvania Rock Oil Company and they had Edwin Drake for looking for oilfields. On 27th August 1859, they drilled the first contemporaneous oil well and it was 450.000 vats in 1860, and 3 million vats total in 1862. On 10th of January 1870, Standard Oil was established by John D. Rockefeller and he had 27% of the company, also in 1875, 75% of purification capacity belonged to the USA. Even though, since the 20th century, the trusts had begun in the worldwide market, it had diminished in the early 20th century. So that the monopolization can be avoided, 35 companies had been detached.

One of the most known oil companies, Shell, was established in 1907 with the unity of Royal Dutch Company and Samuel brothers who produce saver tank ships for overseas transfers.⁵

The Shah of Iran had let William Knox D'Arcy look for oil. Burmah Oil Company had got financial assistance from him, and he had found massive oil strata in Masjed Soleyman. So, the present BP established Anglo-Persian Oil Company in 1909, and have the 97% share.⁶

New Jersey, New York, and California Standard Oil companies have been labeled as dominants of world oil marketplace by the Italian politician since the 1970s. Because the anti-cartel law caused to detach of Standard Oil of Rockefeller family, these companies came from those 34 companies. Then, four companies which are British Royal Dutch Shell and Anglo- Persian (BP), and American Gulf Oil and Texaco from America had forced all the world to pay a ransom.⁷

In order for Saudi Arabia, Venezuela, Kuwait, Iraq, Iran to avoid multinational corporations, they established OPEC (Organization of Petroleum Exporting Countries) on 10th of September 1960. This decision was motivated with the will of protection and prevention of another price discount which was already done 9th of August 1968.

Since there was an oil crisis between 1973-1974, OECD countries created some actions to lessen their economic dependence on oil. So, they established IEA (International Energy Agency)

⁵ Shell, History of the Shell Brand, <https://www.shell.co.uk/about-us/history-of-the-shell-brand.html>, (E.T. 10/01/2019)

⁶ BP, Our history, <https://www.bp.com/en/global/corporate/who-we-are/our-history.html>, (E.T. 10/01/2019)

⁷ F. Al-Nakib, 2016. Kuwait transformed: a history of oil and urban life. Stanford University Press, p.78.

⁸ Nakib, p.83.

in order to fasten to apply the cohesion policy immediately.⁹

2.1.3. Oil Prices

There are four distinguishable categories for crude oil according to the quality and standards of the extraction area.¹⁰

a) BRENT OIL (API 38°): It has 45% sulfur and it is 38° gravity. It is placed in sweet oil category and it is the mixture of 15 different types of oil from the East Shetland catchment area and the North Sea. IPE determines its price.

b) WTI (West Texas Intermediate) OIL (API 40°): It has 0,3% sulfur and it is 40° gravity. It is placed in sweet oil category. It comes from Texas and Oklahoma States. NYMEX determines its price.

c) Dubai (API 32°): It comes from the Middle East and goes through the Asia Pacific

d) OPEC REFERENCE BASKET: As members, Saudi Arabia -Arabian

Light, Dubai- Fateh, Nigeria- Bonny Light, Algeria - Saharan Blend, Indonesia- Minas, Venezuela- Tiajuana, Mexico and Isthmus by Mexico determines the price as approximate.

2.1.4. Oil Reserves

Importance of petrol is growing and the sector is developing in terms of economic and technological issues. OECD and the Middle East Countries provide for most of the world oil producing and circulation of crude oil.

OPEC members rank in producing and the economic issues are like: Saudi Arabia has consistently risen the production for 10 years and the supreme outcome belongs to them in the Middle East. Meanwhile, Iran has been at the second rank, and it has had the biggest portion of share among OPEC. Even though Africa's oil-producing has not changed on a scale, Libya and Algeria have been the most significant producers of oil. Since Nigeria has marked up oil, it has got growing importance.

In 2012, it was proven fact that petrol reserves were 1.477 billion. OPEC has almost 81%

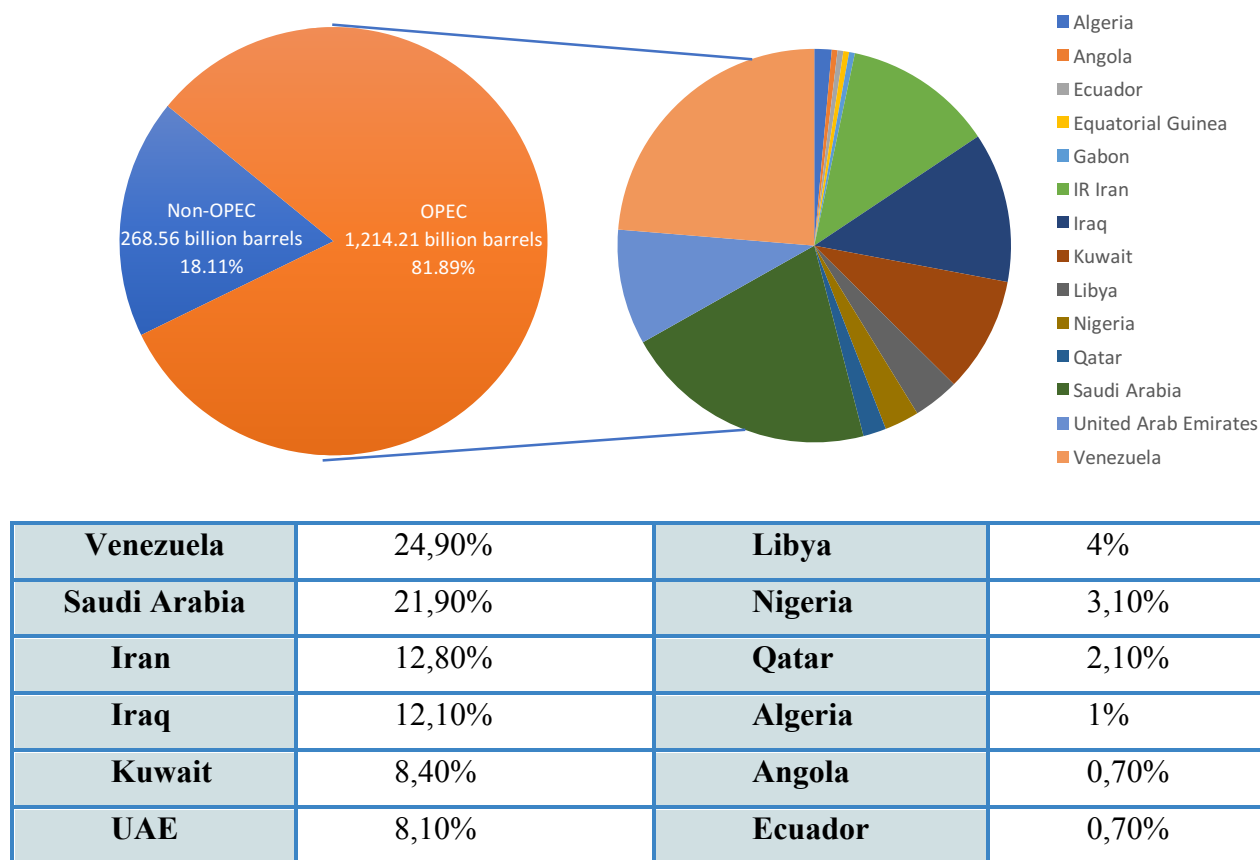
9 A. Malik, 2016. The Impact of Oil Price Changes on Inflation in Pakistan. *International Journal of Energy Economics and Policy*, **6**(4), pp.728-729

¹⁰ J. Bentzen, 2007. Does OPEC influence crude oil prices? Testing for co-movements and causality between regional crude oil prices. *Applied Economics*. **39**(11), p.1378.

and OECD has about 6,6% of these reserves. When the production and reserves are considered in 2017, the reserve is almost 45-years-old.

Venezuela has 24% of all reserves in the world which happens to be the maximum number.

Figure 1: OPEC Share of World Crude Oil Reserves, 2017



According to the existing predictions, it was a proven fact that 81,89% of petrol reserves belong to OPEC, and OPEC's 65,36% is placed in the Middle East petrol reserves of OPEC.

OPEC Countries have interiorized the best implementations of the oil industry and they have significantly contributed to last years' petrol reserves through realizing recoveries and discovering. So, OPEC's proven reserves are about 1.214,21 billion barrels at present

2.2. Oil Price Fluctuations, Causes and Macroeconomic Effects

2.2.1. Oil Price Fluctuations

In this chapter, crude oil price change between 1861 and the end of 2018 has been presented. Having a look at the chapter, it will be clear that until the 1860s, petrol prices increased, however with the discovery of Pennsylvania oilfields, oil prices began to decrease. Even though it looked as if the prices will decrease with the producing on Sumatra in 1890 and finding Spindletop Texas oilfield, and additionally the East Texas Oil until the 1970s, it had stayed stable.

There have been some specific reasons having an impact on oil prices such as war, crises, occupation and political imbalances since the 1970s.

It was the first oil crises started with the consequence of Arab-Israel Conflict which began with Egypt committed an air attack on Israel in 1973. This attack became the continuation of the 6-day war in 1967. Hence, OPEC countries met in Baghdad and made a decision of embargo for those countries which helped Israel. As a result, oil was 2 USD and it increased to 11 USD.¹¹

The second oil crises occurred between June 1978 and October 1981. Shah was overthrown in 1978-1979 and Iran retreat from US economic systems. Moreover, the US-Iran hostage crisis and scarcity possibility in the Iran-Iraq war in 1980 became effective as well. As a result, the oil price was 12 USD and increased to 34 USD in 3 years.¹²

Out of OPEC countries raised their production as much as 10 million barrels per day, and their demand decreased 11%. Meanwhile, OPEC Countries grew their production, so the price went back to 10 USD. Then, Kuwait was occupied by Iraq in 1990, and this caused the oil price to rise from 18 to 24 USD. After that, the Asian Financial Crisis occurred and prices went back to 12 USD in 1998.¹³

As Kohl explained, oil prices were decreased because of Southeast Asia Financial Crises, having a warm winter in North America and Japan, the undersupply demand and the 1998 economic crisis that oil export rising in Russia.¹⁴

¹¹ R. McNally, 2017. *Crude Volatility: The History and the Future of Boom-Bust Oil Prices*. Columbia University Press, p.148

¹² McNally, p.151

¹³ Al-Nakib, p.91

¹⁴ S. Carollo, 2012. *Understanding oil prices: A guide to what drives the price of oil in today's markets*. John Wiley & Sons, p.23.

In 2003, oil price raised from 28 to 56 USD because of the occupation of Iraq. In 2006, oil prices increased again because of challenges Iraq, Nigeria and Venezuela faced growing demands of India and China and Hurricane Katrina. In 2008, since the FED made a major interest cut so that it would prevent a recession, and the concerns about retreating US finance, oil prices raised from 60 to 130 USD.¹⁵

In July 2008, per barrel was 147 USD and 2 months average was 40 USD. However, it went up to 80 USD at the end of 2009 because of demand and supply.

On the 17th of November 2010, Tunisia faced the rebellions and internal disturbances against the regime that was totalitarian and dictatorial. These reactions started the Arab Spring which affected the Arab countries in North Africa and the Middle East. Since the Arab Spring happened in fundamental regions for the production of oil in the world, producing decreased and prices increased as a result.¹⁶

At the end of 2014 when oil constant was at a maximum level, oil prices went down 50%, and the reason was found in three things: suppliers, demanders, and international money market.¹⁷

Improvements in Supply:¹⁸ US Energy Information Administration presented data in 2012 and it was seen that in the oil production Saudi Arabia was preceded the US with a 13,7% share thanks to some improvements like; geological mapping works, drilling in a horizontal way in shale gas, and hydraulic fracturing. In a few years, the USA is expected to be the oil exporting country. Comparing with earlier, Iraq grew the oil production, even though ISIS (Islamic State) terror organization occurred in Kirkuk, political imbalances in Lebanon, and lowering of oil production oil production. On the other side, in the seaward region of Brazil, fresh oil fields were found to be the new supply and lowered the oil price.

Improvements in Demand:¹⁹ Since renewable energy politics have gained importance with the energy efficiency concerns in developed countries and especially in the USA, oil demand

¹⁵ R. Bharati, & J. S. Crain, & V. Kaminski, 2012. Clustering in crude oil prices and the target pricing zone hypothesis. *Energy Economics*. **34**. pp.1115-1123.

¹⁶ R. F. Aguilera, & M. Radetzki, 2015. *The price of oil*. Cambridge University Press, p.48.

¹⁷ Aguilera & Radetzki, p.53.

¹⁸ US Energy Information Administration, Petroleum & Other Liquids <https://www.eia.gov/>, (Date of Access: 19/02/2019)

¹⁹ J. M. Griffin, & D. J. Teece, 2016. *OPEC behaviour and world oil prices*. Routledge, p.19.

and price dropped.

Improvements in the Money Market: Currency of USD has increased because of the expectancy of an interest rate hike of FED. That's why, oil price at first, and other goods price have decreased.

Having a look at the way of international oil price West Texas and Brent Oil, both of them experienced the same way. The oil crises which began in the 1970s went through the early 1990s. At the end of the 1990s, oil price stayed stable. Until that time, their decreasing took the world's attention. Oil price stayed about 15-20 USD/barrel between half of 1987 and the end of 1997. Since the 2000s, oil prices have significantly increased. They were 25 USD/barrel in the first half of the 2000s and then it went up 130 USD/barrel in 2008. In 2009, the global economic crisis happened, which caused decreasing oil price which was interesting at that moment. At the end of the year 2009, Brent Oil that had the maximum constant level of 2014 in the first half of June (11 USD/barrel), had 50% fallen (56 USD/barrel) and continued until January 2015.²⁰

2.2.2. The Causes of Oil Price Fluctuations

There are three types of effect on the oil price: Short term (2 years), medium term (7 years) and long term (8-20 years). Supply-demand stability, geopolitical position, fictional news, shares, OPEC, and global crises are short term effects. On the other hand, investments in the sector, OPEC are medium-term effects, and lastly, financial growth, variant energy sources, OPEC, climate change and investments are long term effects.²¹

Supply-demand stability:²² The most important element is the supply- demand stability. In order to determine the oil price which has different actors and dynamics like trade goods price, all the trade actors in the sector must be considered. Since OPEC had taken into account neither the serious Asia crises between 1998-2000 nor growing production capacities, the supply and demand stability was broken down. So this created an oil price drop.

Geopolitical Positions:²³ On the other hand, countries' policies and geographical features

²⁰ J. Rees, 2017. Natural resources: allocation, economics and policy. Routledge, p.149.

²¹ Griffin & Teece, p.37.

²² L. Kilian, & B. Hicks, 2013. Did unexpectedly strong economic growth cause the oil price shock of 2003–2008?. *Journal of Forecasting*, 32(5), p.391

²³ C. Baumeister, & L. Kilian, 2016. Forty years of oil price fluctuations: Why the price of oil may still surprise us. *Journal of Economic Perspectives*, 30(1), pp.139-60.

constituted their geopolitical circumstances. In 2008, there were many situations which affected the oil price. Iraq tried to keep stability at the end of the invasion, but it failed. Venezuela tried to have new policies to implement, but it caused the growth of nationalization. Nigeria had terror attacks, Gaza was occupied. Iran kept its nuclear activities and lastly, Russia intervened in Caucasus issue in Georgia.

Fictional News and the Economy Market: There were some fictional news and speculations in 2009. The mortgage crisis, economical determiners, hedge fund, interest rate, and dollar-euro currency rates were explained by Oktem and Demirkul. Besides, Kaufmann and Ulman asserted that prices that are determined in the futures and spot market have a low correlation.²⁴

On 10th of September 1960, OPEC was established with several aims by Saudi Arabia, Kuwait, Venezuela, Iran, and Iraq. Their main purpose was to protect both producers and consumers. They decided to create a price system that assures the producer countries. In order to do this, they tried to keep the price in balance by avoiding unknown change decisions that are possible to be made by oil corporations. OPEC did not function well because their members could not establish a good relationship. According to BP data of 2018, OPEC had 80% of all the reserves in the world. Even though OPEC is the most effective producer all over the world, they did not use their whole capacity to produce and had a negative influence on oil price. There are some global risks about decreasing the production of oil. These are, for example, shocks, peaking the oil by non-OPEC countries, improving technology effort to find new reserves, and lastly OPEC's standing as a damper of oil supply.²⁵

Another point, if there is a safety problem for oil supply, stocks take a role in maintaining oil current to keep the chain of supply. Like this, OECD countries raise their stocks, OPEC diminishes their production quotas, in order to avoid lowering of price which has already been previously indicated constants. As Oktem and Demirkul expressed in 2009, in the USA, global economic crisis triggered the Mortgage crisis in 2007. This led to a liquidity shortage. In this point, it is seen that if the oil demand raises, prices drop, and countries' improving constant raises, oil

²⁴Ersin Öktem & Zafer Demirkul, Petrol Fiyatının Dinamikleri ve Geleceği, TPAO, http://www.emo.org.tr/ekler/44154d24b30c881_ek.pdf?tipi=2&turu=X&sube=7, (Date of Access: 22/03/2019)

²⁵ BP, Statistical Review of World Energy, <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>, (Date of Access: 23/03/2019)

demand raises. So, there is a positive correlation between oil price and financial development.²⁶

Sectoral investments were defined as oil studies, improvements and anticipated investments in the sector by Gholz and Press in 2007. Although these actions will take recycling after many years, they are very important in determining the price. Oil is a source that may run out, and that situation triggers people to tend to alternative energy. However, the price of natural gas is as much as oil price. So, in a medium and long period, alternative sources have influenced in oil price. In addition, Hurricane Katrina as a natural disaster which occurred because of climate changed has reflected the oil price in a short period.²⁷

2.2.3. The Macroeconomic Effects of Oil Price Fluctuations

There are some explanation tools for the correlation between oil price oscillation and economic activities. These are money policies, sectoral changes, transfer reflection, supply-side effect, legislation costs, real balance effect and indeterminacy in the literature.

First of all, Supply-Side Effect explains that economic activities are affected by the raised oil price through diminishing reaching to entries. The energy which is the main entries of production raises the scarcity, and the expensiveness of oil price presents this situation. As a consequence, competence and growth in the output of production decrease. Because of the decrease of competence, the unemployment rate as one of the reasons for inflation will raise. On the other side, real wages growth will get lower. In this point, consumer behavior should be looked at. They try to hold stable the consumption through economizing less or owing more if they are aware that this oil price hike is not constant or short period effect as a major longer effect. However, if the consumers owe more, interest rate raises. Hence, production output drop and real interest increase has an impact on a drop of real money demand and increase of inflation rate. Consequently, it can be said that if oil price increases, GDP will go down, inflation and real interests will go up. Unemployment goes up because of GDP growth drop if nominal wage decreases sharply. Therefore, GDP growth will down as well. So, falling labor competence has been the first root for the decrease in GDP.²⁸

26 Öktem & Demirkul, pp.5-8.

27Aguilera, & Radetzki, p.51.

28 T. Lorde, M. Jackman, & C. Thomas, 2009. The macroeconomic effects of oil price fluctuations on a small open oil-producing country: The case of Trinidad and Tobago. *Energy Policy*, 37(7), pp.2708- 2716.

Total Demand and Transferring Income: Secondly, the oil price has an effect on economic activities. When oil exporting countries diminish or raise total demand, purchasing authority changed from importing to exporting countries. As it had been experienced before, the demand increase in importing countries is more than exporting countries. The reflection which is importing countries' decreasing demands causes a lowering of real interest rates and up of world economizing supply. Interest rate decrease demolishes consumption lowering rate, and total demand stays stable. However, interest rates are the one that raises the investing.²⁹

So, some possibilities occurred here. First one is a harsh price decrease. If it happens, GDP decrease raises with a consumption drop of the commodities of oil exporting countries. Also, constant costs decrease need to lessen price constantly. Secondly, if the price stays stable, investment outgoing will be less than consumption outgoings. So, the growth of finance is getting slower.

In order to create a new balance, lessen price constant is needed to go down in total demand. Unless the real price constant falls, investment outgoings increase will be less than consumption outgoings decrease. So, demand in the Constant of a result will fall. There is only one way to understand nominal price decrease and real price. It is the improbable inflation raise in which GDP growth's constantly decreases.³⁰

Real Balance Effect:³¹ Thirdly, one of the other results of increasing oil price is to raise money demand. So, the interest rates will rise, if increased oil price and money supply that meets monetary authority cause an increase in money demand. As a result, a negative impact will be on finance growth.

Money Policies³² Fourthly, Oil price shocks are touched by monetary policy. In nominal GDP constant growth, if money authorities hold the growth, the inflation rate will rise within the rate of slowdown in GDP growth.

On the other side, the cash flow rate will rise in line with the increase of the real interest

²⁹ K. A. Mork, Ø. Olsen, & H. T. Mysen, 1994. Macroeconomic responses to oil price increases and decreases in seven OECD countries. *The Energy Journal*, 15(4), p.21.

³⁰ Lorde, Jackman, & Thomas, p.2712.

³¹ K. A. Mork, 1994. Business cycles and the oil market. *The Energy Journal*, 15(Special Issue on the Changing World), pp.15-38.

³² : S. P. Brown, & M. K. Yücel, 2002. Energy prices and aggregate economic activity: an interpretative survey. *The Quarterly Review of Economics and Finance*, 42(2), pp.193-208.

rate that caused the oil shocks. So that monetary authorities can protect the growth rate of nominal GDP constant, they raise the interest rates. Therefore, it will be seen the monetary growth rate will go down. However, if the authorities hold the growth rate stable, as the cash flow rate rises, then the GDP growth rate will rise. In the case of money authorities' stabilizing the real interest constant, inflation and monetary improvement rate increases. The same monetary policy is able to provide the constant interest, monetary improving and nominal GDP growth rate unless the oil price shocks impact the real interest rates.³³

Moreover, mistake possibility of monetary policy rises with the oil price shocks. On the other side, both anti-inflationary money policies and oil price increase, nominal GDP's growth rate decelerates. Also, nominal and real wages affect each other and, as one decreases, also the other one does, as well as competence. Therefore, total consumption goes down, GDP growth rate decelerates, and on the other hand, unemployment increases.

Legislation Costs:³⁴ Economical activities go badly because of increasing oil prices. Since changing prices and increasing costs, there were some regulations made to figure out the sectoral imbalances, companies' coordination issues, or energy production rate in capital stock. Even though companies are ready to face some predictable situations because of the oil price increases, they cannot predict the others. Therefore, it is seen as a huge coordination problem in this case. Also, each activity that companies do to regulate themselves with the prices, affects the sector in a negative way.

Indeterminacy: Unpredictable increases in oil prices cause indeterminacy on oil prices later. Then, this indeterminacy causes a decrease in investments and postponement of investments of the companies. Only if capital includes the technology, then the companies necessitate indicating the energy density in the process of producing as they buy capital. If the investor does not rely on the company because of the higher prices, then the interest rates which companies pay for commodity go up.³⁵

³³ Baumeister, & Kilian, p.143.

³⁴ A. B. Lovins, & E. K. Datta, 2005. Winning the oil endgame. Innovations for Profits, Jobs and, p.140.

³⁵ F. D. Tchatoke, N. Groshenny, Q. Haque, & M. Weder, 2017. Monetary policy and indeterminacy after the 2001 slump. Journal of Economic Dynamics and Control, 82, 83-95.

2.3. History of Oil Prices

2.3.1. Before the World War I

As a commodity crude oil price has an advantage in high liquidity. So, today's economy participators such as merchants, firms, banks etc. take an interest in this. Most of the countries export or/and import this type of oil, so countries' income situations care about the price. Liquidity of the crude oil markets can be clarified with the dependency of last technologies of a motor.³⁶

In 1859, Edwin Drake pulled out crude oil with a new way, which was cheaper than pulling out from coal, from 69,5 feet. That caused a revolutionary attempt in the oil sector and made him a first known oil driller. Until the end of 1861, since the number of production increased in this way, prices went down from 10 USD/barrel to 9 USD/barrel.³⁷

Since the production had increased in the US, its political and financial incidents had been effective on primary crude oil prices. In 1862-1864, it was the first oil price shock because of the American Civil War. Annual average was 1.05 USD/barrel in 1861 it went up to 8,06 USD/barrel in 1864 because of supplies drop and alcohol tax ordinance. Average in 1864 was even higher than in 2019 February conditions.³⁸

Annual Average in 1864	119,6 USD/barrel
Annual Average in 2019	62,01 USD/barrel

The Civil War passed and for the first time long-distance pipeline transportation system was developed in 1879. Thanks to this, transportation costs went down and oligopoly in railroad transportation was over. After 1877-1878, eleven different prices structurally changed and low-volatile term began.³⁹

In the US, the industry had rapidly and importantly developed after the Civil War. Meanwhile, oil production had risen. When it comes to the 20th century, oil started to be used in industry, which made the oil trade significant input for the economy of the US, and automotive trade was increased.

36 JD. Hamilton, 1983. Oil and the macroeconomy since World War II. Journal of political economy, 91(2), pp.228-248.

37 Mork, Olsen, & Mysen, p.27

38 Baumeister, & Kilian, p.143.

39 Carollo, p.23.

2.3.2. 1914- 1918 Period (World War I)

During WWI, the US got the military power it needed and more thanks to the control over the oil fields. Before WWI, US armada had been altered from coal- based to fuel based. This provided the US for farther range and more speed. Also, US allies got the energy they need from the US, and they had strategic superiority on Central Powers. In 1913-1915, the prices went down 35% (according to 2013 USD). Then, in the 1915-1918 period, it doubled itself, and lastly, in 1917, the biggest recovery happened with the Russian February Revolution.

2.3.3. 1920- 1939

Financial situations and the main elements on industry had changed with the oil use in transportation. For example, in the US some registered cars rigidly rose at the beginning of the 21st century. Between the years of WWI and Great Depression of 1929, many supply-demand changings had happened, and that caused oscillation of the prices. It means, there had not happened a constant increase or decrease in real and nominal terms.⁴⁰

Great Depression and the finding the East Texas fields made prices down in a rigid way;

1929	1,27 USD/barrel
1931	0,65 USD/barrel

In the 1930s, private car usage of US citizens rose. Before World War II, 1/3 of US total consumption of energy had been provided with oil. In addition, Japan and Western Europe had been in charge of 10% of the total consumption of energy. In 1932, 49% (2013 USD) price increase was seen after the Great Depression. Between 1933- 1934, it was an incalculable term with a structural crack. Then between 1933-1973, it was a more stable term. Lastly, between 1932 and 1939 (World War II), the prices went up a little.⁴¹

2.3.4. 1939- 1945 (World War II)

World War II has been the most devastating incident in human history. It was a war between the world powers which decided strategically based on oil sources by allies and pivots. During the war, all tanks, big boats and planes were powered by oil, so the oil was an essential meta for the

⁴⁰ Parra, p.81.

⁴¹ Mork, p.27

world powers. Both sides of the war were clearly conscious of how important it was to control oil areas for tomorrow. The leader in producing oil was the US. So, this formed the balance of power during the war. British and French states had oil sources which needed security for entrance, and they were in the Middle East and the Western Hemisphere. Moreover, allies menaced so that Germany and Japan stayed away from the sources.⁴²

During WWII, Germany's 95% of energy demand had been covered by the synthetic fuel industry which Adolf Hitler had developed. Yet, this had not been enough for whole demand and Germany attacked the Soviet Union in order to have Caucasus' oil sources. Since the US made a decision in applying an embargo in order for Japan not to use US oil sources, Japan occupied Pearl Harbor. These embargos the Soviet Union and the US applied for Japan and Germany, became the end of WWII with the defeat of Japan and Germany.⁴³

Between 1940-1944, the annual average stayed at 16 USD/barrel (2013 USD). Yet, it changed and decreased 15% in 1945.

2.3.5. The Cold War and The Postwar

Dominating the oil resources had gained huge importance due to the fact that it was proof that having success depends on those resources during the war. So, WWII was ended only in a physical way, yet it continued in fact. The US and the Soviet Union had the same interest for the Persian Gulf oil resources and they both took some actions. Then, the US and Great Britain withdrew from Iran and the US placed against the Soviet Union near Iran. After the war, the US supported Iran's Shah and had a noticeable function in Iran's politics. In 1946-1947, the annual average of the oil prices rose 70% due to US and communist pact's Cold War.⁴⁴

On the other hand, since the Arab World had a big part of oil sources, the US Military Department had a special attitude in their relation. It was possible for the Soviet Union to enter in the oil sources in the Middle East and it would be a big strategic superior for it, and the US knew that. So, opposite of Truman's statement, these segments were unwilling to support the UN on Palestine's dividing up in 1948. Furthermore, the Middle East attracts the US companies, that's

⁴² R. Heinberg, 2005. *The party's over: oil, war and the fate of industrial societies*. New Society Publishers, p.163

⁴³ David S. Painter, 2012. Oil and the American century. *The Journal of American History*, **99**(1) pp.24-39

⁴⁴ M. R. Farzanegan, & G. Markwardt, 2009. The effects of oil price shocks on the Iranian economy. *Energy Economics*, **31**(1), pp.134-151.

why the companies promoted the Marshall Plan as much as 10% at the total.

In Iran, there was a rising nationalization scaring the US and Great Britain which had investments and contracts in the Middle East. Iran protested because of the oil exports, and this was the first reflection on nationalization of the council and it ended up with a decrease of 19 million monthly supply of oil. In 1953, there was a coup of the Shah in order to solve the issue. As a result, the annual price rose 13% and stayed like this until 1958.⁴⁵

In 1956, Due to the fact that it was the transferring way of $\frac{2}{3}$ of oil from the Persian Gulf, British and French attacked Egypt because of the nationalization of Suez Canal Company. This attack discomforted the Arab World and they embargoed the export to Great Britain and France. As a result of that IMF (International Monetary Fund) stopped the contribution to Great Britain, so France, and Great Britain withdrew.

In 1970, OPEC (Organization of the Petroleum Exporting Countries) affected oil prices remarkably. Until that time, oil prices had decreased when it came to the end of 1960 and it was 1,80 USD/barrel. Furthermore, in 1971, the Bretton Woods System was upside down. As a result of this, the dollar shrank against the goods, and at the beginning of 1970, the annual average rose 38%, until 1972.

2.3.6. 1973-1985

It was the unstable term for the oil prices between 1973 and 2009, just like 1861-1878 term. Israel backers which had supply crunch were embargoed by OPEC countries in 1973.⁴⁶ Even though other countries continued producing, that crunch could not be covered, and this was reflected in the prices;

1973	3,29 USD/ barrel
1974	11,58 USD/barrel

Painter states that Iran had an upgoing gain through oil between 1973-1974, and this caused an imbalanced income distribution among the citizens. Yet, the government had to limit their spending, civil protest, etc., because of the oil income decrease in 1978. In 1979, it was not the best time in Iran. The Shah ran away and the Iranian Revolution ended up with loss of oil and oil prices

⁴⁵ Farzanegan, & Markwardt, p.142.

⁴⁶ Painter, p.28

went up twice. Then in 1980, the Iran-Iraq War started and although the oil consumption went down all around the world, the prices were kept the same. So, between 1981-5, the annual average went down at the rate of 65% (2013 USD) despite Saudi Arabia lessening the producing at a rate of 75%.

2.3.7. 1986- Today

In 1986, the oil prices went down at the rate of 50% and the prices oscillated within the year. Its reason was changing the pricing system of Saudi Arabia. Saudi Arabia stopped the cuts in production and a new premium system for not the price but the volume came.

In 1990, Kuwait was raided by Iraq and the prices went up double at the end of the year. However, the prices went back to normal due to coalition force interfering with Iraq at the beginning of 1991.⁴⁷

Then the well-known Asian Crisis occurred in 1997. The oil prices were upside down since the demand went down significantly. In 1998;

Brent (average)	12.72 USD/barrel
WTI (average)	14,4 USD/barrel

While the prices were on the rise because East Asia was stabilized in 1999- 2000, in 1999, the prices had oscillation due to the will to make things better around.

In the US, financial activities retarded. In 2001, oil prices went down because of the recession. In 2003 until the ameliorations in the financial area, the annual average of WTI went up 31 USD/barrel. On the other hand, both demand and supply stirred up the price recovery in 2003. At the end of 2002, the oil supply was down because of Venezuelan Strike. The prices which were about 2,1 mbbl/d began to rise up. Furthermore, the US invaded Iraq and it resulted in the oil crunch at the beginning of 2003.

When it comes to the end of 2003, it can be mentioned a tendency of increasing oil price, until 2008. From 2003 to 2005;

2003-2004 annual average	WTI	33,5% increasing
2004-2005 annual average	WTI	36,5% increasing

⁴⁷ Farzanegan, & Markwardt, p.139.

The oil supply rise was lower than real gross production of the world, and this resulted in strict rising in the prices. In the period 2004-2006, out of OPEC countries' demand for supply fell behind the OPEC's. In 2008, oil prices went up much then 145 USD/barrel. There were many elements of this. Although it was perceived that these rigid increases resulted from some speculative situations, actually it was because that proportioned demand curve was more noticeable than the modified change in the supply curve. Extra oscillation occurred by the economic productions which are speculative trading, and this situation was not seen noticeably. So, it was seen that it rose up in early 2008 and down at the end of 2008, so it was possible to say that speculations which came from the market were responsible for that. In the literature review, it coincided that speculations which affected the crude oil prices were criticized. They sought for the answer for if the rule of crude oil can clarify the price changes or not. Granger causality test was applied on WTI prices and the situations of traders. As a result, not the prices affect the positions, but the positions affect the prices.⁴⁸

In 2007, the global economic crisis occurred and intensified in 2008. This crisis impacted the oil demand in a negative way very much. In the middle of 2009, economic recovery was quickened by the financial measures which had been loaded by the US. As a result, the end of 2009 saw the oil price increases. The global economy influenced the crude oil price in an increasing way in 2010, so WTI average rose at a rate of 28%.⁴⁹

When it came to 2010, it is mentioned that the Arab Spring occurred in Tunisia. The Arab Spring was one of the reasons for oil supply disruption and it reflected MENA's geopolitics around. Furthermore, in the same year, there were many natural disasters such as tsunami, earthquake and nuclear disaster in Japan, which became a reason for nuclear energy capacity deprivation, and the other deprivations that normally covered by the oil. So, the 2011-2012 period was an increase term both for oil demand and price.⁵⁰

Oil trade sector kept producing speculations which created oscillations and that is why this increase period was kept until April 2012. On the other hand, the oil prices were influenced by

48 Louis H. Ederington et al, 2011. Factors Influencing Oil Prices: A Survey of the Current State of Knowledge in the Context of the 2007-08 Oil Price Volatility, <https://pdfs.semanticscholar.org/b2e4/744adb572b7b46bc216a76534e6d9cf26f13.pdf>, (Date of Access: 01/03/2019)

49 Mamdouh G Salameh, 2015. What is Behind the Steep Decline in the Crude Oil Prices: Glut or Geopolitics?, Arab Center for Research and Policy Studies, p.37.

50 D. Caldara, M. Cavallo, & M. Iacoviello, 2018. Oil price elasticities and oil price fluctuations. *Journal of Monetary Economics*. 12(57), pp.4-6.

some other components such as supply turnover, global financial improvements, and obstacles in streaming. As a result, recovery was observed: the annual average of WTI was 94,1 USD/barrel and Brent was 111,6 USD/barrel.⁵¹

For a while, prices stayed around 100 USD/barrel due to oil demand increase and oil-used transportation system in Asia. Yet, with the end of 2014, the prices went down from 100 USD/barrel to 50 USD/ barrel. Until the last quarter of 2014, there had been two more declines, however, this was the biggest third. There are three main reasons for these declines.⁵²

First one is OPEC's price policies, the second one is some development in geopolitical issues and the third one is value increase in USD. When it came to 2018, it was seen that the annual average is 69,52 USD/barrel. In this point, it is possible to mention some possibilities that futures markets guessed. Brent may rise 75 USD/barrel in 2020 which could be an oscillation that the last experiences which Brent is around 65 USD/barrel showed in the increasing tendency.⁵³

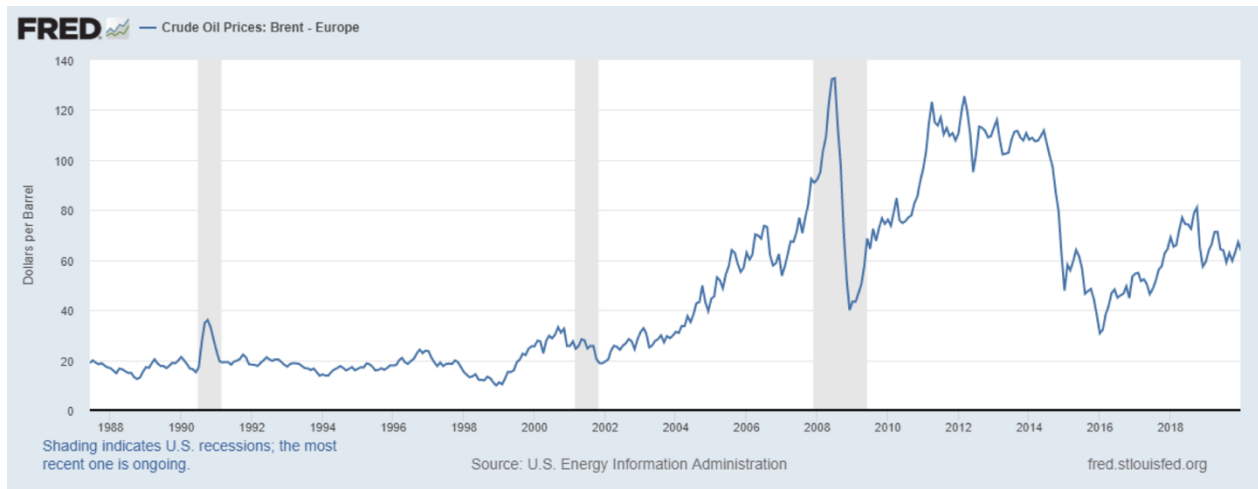
The reference axis for oil prices of IMF, futures contracts are used. Unfortunately, there is a point that is ignored. In this point, price predictions that are for the futures are matchless. The institutions which already used these modelings also have missed the price decrease. IMF personnel who created alternative supply-demand modeling make some prediction about risen prices in long-term which provides covering the rising demand through guaranteeing adequate investments, yet there is not accurate info.

⁵¹ Salameh, pp.8-9.

⁵² Irma Alonso Álvarez, & Virginia Di Nino, 2017. The oil market in the age of shale oil. ECB Economic Bulletin, **8**, pp.57-58.

⁵³ Caldara, Cavallo, & Iacoviello, p.7.

Figure 2: Crude Oil Prices



Source: Macrotrends, Emtia, <https://www.macrotrends.net/1369/crude-oil-price-history-chart>, (25/02/2019)

Since 1970, there have been 4 major oil price shocks in the world economy:

Table 1: Price USD

Number	Year	Reason	Before	After	Rate
1	1973	OPEC's decision to limit the supply	11,24	20,18	80%
2	1980	The Iran-Iraq War	19,67	53,74	173%
3	1990	Kuwait intervention of Iraq	16,62	24,55	48%
4	1999	the US- Iraq War and the Middle East geopolitics challenges	11,27	15,9	
5	2000	the US- Iraq War and the Middle East geopolitics challenges	15,9	26,72	

Source: Macrotrends, Emtia, <https://www.macrotrends.net/1369/crude-oil-price-history-chart>, (25/02/2019)

To sum up, the first shock was because of OPEC's decision on oil supply in 1973. The second shock was because of the Iran-Iraq War in 1980. The third one was because of Kuwait intervention of Iraq in 1990. The last one was because of the US- Iraq War and geopolitical problems faced in the Middle East in 1999-2000. These shocks caused some rigid fluctuations and

ended up with increases.⁵⁴

In the international markets, from 2003 to 2008, oil prices rapidly increased. It can be seen that growing global economy parallelly raised oil demand and speculative factors had roles. However, an unpredictable global economic crisis rechanged the situation, and as a consequence, it decreased the price of oil and the other commodities.⁵⁵

In 2009, it was a process in which oil prices went down fast. After the mortgage crisis which began in the US in 2008, due to the fact that fast-growing trend and the Arab Spring created an expectation for oil supply to lessen, oil prices which went back even to the level of 60 USD started to increase again. Hence, the oil prices which increased up to 160 USD in the world market navigate a higher than 100 USD since 2010 -lasting four years.⁵⁶

From June 2014, the increasing trend turned into a rigid and constantly decreasing trend. It was such a decreasing period that the oil prices which even decreased to about 50 USD at the beginning of 2015 still could not reach the expected high levels. Moreover, as a result of the deal which was made between Iran and the Western States about nuclear negotiations, the prices plummeted to record low levels of 56,32 USD right after April 2015.⁵⁷

The huge decrease which was at the level of 60% in shorter than a 9-month period and became effective on the global economy has been evaluated as the only and the most important macro event in the last 10 years.

On the other hand, the oil prices kept changing and it went back to 30 USD in February 2016. In 2017, the oil barrel price was dealt 47,23 USD. So, when it is considered the changing oil prices since 2014, a 70% decrease has been observed. As a result of this, West Texas Intermediate (WTI or NYMEX) presented through their interactional diagrams, crude oil prices as USD/barrel went back to 1946 conditions.⁵⁸

The oil prices which are arranged according to inflation by using CPI and it is presented as in a logarithmic level as a hypothetical. The present value is the current value and updated hourly.

⁵⁴ Aguilera, & Radetzki, p.87.

⁵⁵ McNally, p.153.

⁵⁶ Malik, p.732.

⁵⁷ A. Demirbas, B. Omar Al-Sasi, & A. S. Nizami, 2017. Recent volatility in the price of crude oil. Energy Sources, Part B: Economics, Planning, and Policy, 12(5), pp.408-414.

⁵⁸ Demirbas et al, p.409.

As it is seen in Figure 2, according to the latest update, WTI crude oil price is 57,26 USD/barrel on the 22nd of February 2019.59

3. TURKISH EXCHANGE MARKET AND OIL MARKET IN TURKEY

This section has been constituted of three main parts. Firstly, oil has been defined and described its characteristics. Secondly, the history of oscillations in oil prices worldwide have been presented, the elements which have roles in the oil price and the tools of oscillations of macroeconomics. Lastly, it has been exposed the theoretical approaches for the relation of economic growth and the consumption of the energy, and literature review done has been presented in the charts.

3.1. Role of Turkey in the Oil Market

Today, Turkey imports 50% of consumed energy resources and such policies in Turkey are highly impacted through world energy sector's common structure. When it is considered the natural and geological structure of Turkey, other lignite and fossil resource reserves and their production is quite low.

Turkey's energy consumption is:

Oil supply	39%
Natural gas	27%
Coal	27%
Renewable energy	13%

As is seen in the table, the most important part of energy consumption is covered by the oil supply, then the natural gas and the coal are equal, and the renewable energy which is the most important and inevitable future source of us.

In energy consumption, it is a 70% share of import. Moreover, Turkey is highly dependent on importing energy, and import which creates stressfulness in the concept of energy security of 65% of natural gas is made from the Russian Federation. Turkey's geopolitical place makes it be

59 Markets Insider, Emtia. <https://markets.businessinsider.com/commodities/oil-price?type=wti>, (Date of access: 10/03/2019)

in significant projects, due to the fact that Turkey is contiguous to the countries and regions that include $\frac{3}{4}$ of natural gas and world oil reserves. Until 2030, most of the energy demand of the world in a primary level is expected to have covered by our and neighbor region.

On the other hand, while the energy market cares about the reserves, it is important for the consumers to have the service in a proper and to provide a secured transporting through the pipelines. That's why it is necessary to keep safe the trade routes and supply-demanders.

Turkey, in order to use its favorable strategic situation, stays close to energy security. Clearly observed in the figure that Turkey's place is in a crucial point with regards to conduction paths.

Figure 3: Oil Transport and Natural Gas Lines (General)



Source: BOTAS, 2018.

3.1.1. Turkey's Role Oil Production

In Turkey, the Turkish Petroleum Corporation (TPC) carries out almost all activities of the oil. As a most significant and in-depth organization, TPC carries out exploration, producing, drilling, and refinery actions of oil and byproduct.

In Turkey, both numbers of oil reserves and production are at a low level. Turkey's annual

average of oil production was 51.000 barrels in 2016 and in the same year, a 7% rate of production covered the consumption. In 2016, it was realized the producible reserve number is 334,5 barrels.

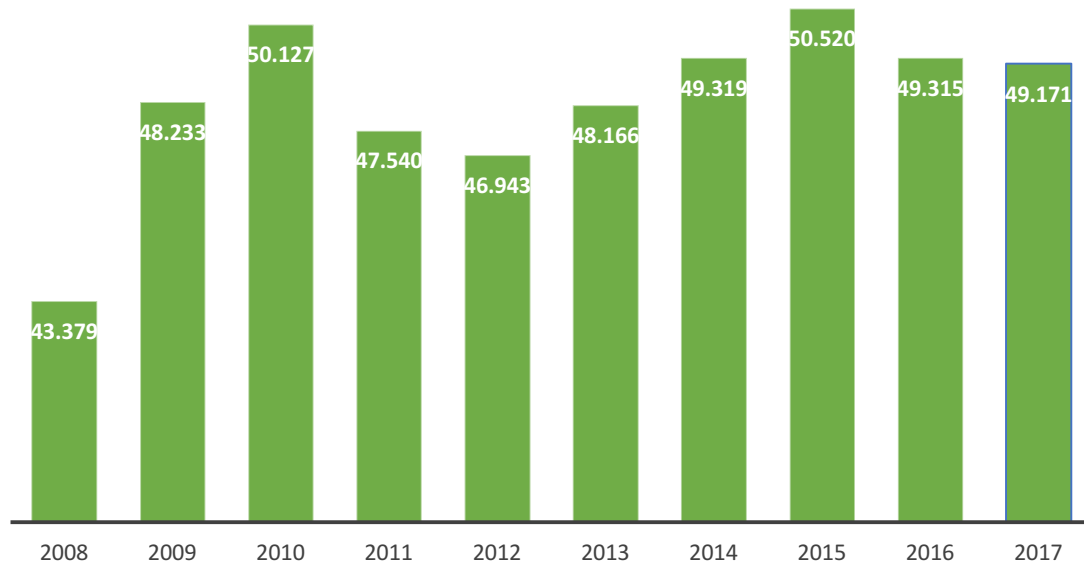
70% of world producible oil reserve is placed neighboring Turkey. Especially, there are ongoing works that have been accelerating in the Black Sea and the Mediterranean in the last years. There occurred a chance to research and produce in water depth places (1000-2000 m) through the developments on offshore-drilling technology. Therefore, this has been the basis of hydrocarbon researching in Turkey. In addition, Turkey has set two seismic research and one drilling ships.

In recent years, Turkey's oil and gas demand has risen particularly in Land areas and the Black Sea area, so there have been done many projects on production and exploration of oil and natural gas. In Figure 4, it is given the quantities of production between 2008-2017. So that the oil production increase, TPC has inducted many reservoir works and accelerated the projects.

- West Raman Field Oil Production Upgrade Project
- Raman Field Production Increase Project
- Garzan Area Water Injection Project
- West Kozluca Area plans to raise oil production via the WAG (CO₂ / Water-Sequential-Gas Injection) Project.

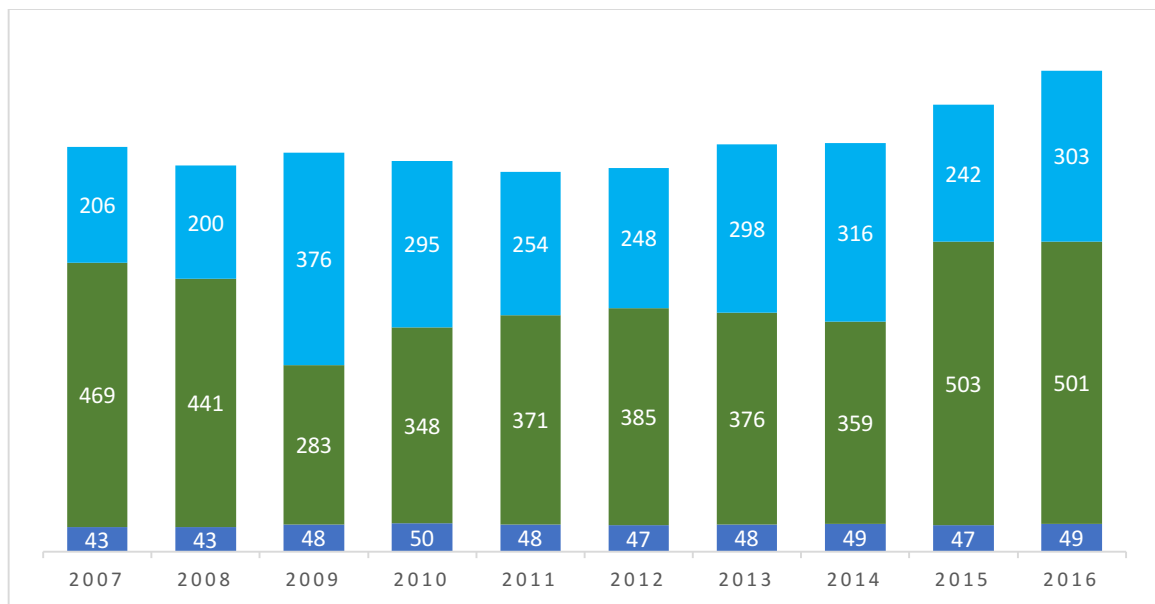
In 2017, Turkey produced 17,9 million barrels of oil (49.171 v/g). Turkey produces the oil and natural gas inland sides except for Akçakoca marine side natural gas production. In 2017, 41 research and evaluation boreholes and 45 production boreholes were drilled and in total, 86 boreholes were drilled. The main reason for the decrease in exploration and drilling activities in 2015 and 2016 is the decrease in oil prices and the reduction of the resources allocated to the exploration activities of the companies. In 2017, an increase in exploration activities was observed due to the relative increase in oil prices compared to the previous years.

Figure 4: Annual Crude Oil Production



Source: Turkey Oil, Oil Production, <http://www.tpa.gov.tr/?mod=.sektore-dair&contID=37>, (23/02/2019).

Figure 5: Annual Crude Oil Consumption



Source: Turkey Oil, Oil Production, <http://www.tpa.gov.tr/?mod=sektore->

[dair&contID=37](#), (23/02/2019).

In 2017, a daily average of 49.000 v/g crude oil was produced and in return,

550.000 v/g crude oil was consumed. 517.000 v/g crude oil imports and 339 thousand v/g processed products import were realized. In 2017, the ratio of domestic crude oil production to total consumption was 5.4%.

3.1.2. Oil Price Formation

It is a supply-demand balance structure to form the oil prices as well as other market goods. The oil market is a bit different from the others, due to the fact that the other markets' financial activities are dependent on the oil and this can be direct or indirect. In addition, the oil reserves are measurable, 77% of reserves and 42% of oil production belongs to the OPEC members. Furthermore, some components cause the speculations which cause huge oscillations in oil prices. These components can be the effectors and anticipators of short-long period imbalances on supply-demand.

3.1.3. Turkey's Oil Prices

Regimentation is the fundamental thing in determining and the increase in oil price, as much as exchange rates and oil price in the world. Turkish State demand Special Consumption Tax (VAT) and VAT (Value Added Tax) for the oil prices. As Fuel Consumption Tax including in this tax, Excise Tax with the remove of funds were transferred to the function of The Fuel Price Stabilization Fund which had modified the oscillations of the oil prices in the country before and also had profit.

Table 2: Turkey's Oil Prices

	2000	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012
Crude Oil Price (S)	8,4	4,9	8,8	4,4	5,1	2,5	7	1,5	9,4	11,2	11,5
Import (1000 Ton)	1,08	3,7	24,2	3,39	3,78	3,44	1,83	4,21	16,87	18,04	19,47
Import Value (Million \$)	4.208	4.088	4.777	8.649	10.706	11.784	15.639	6.415	9.647	14.888	16.133
Share of oil price in imports	13,94	14,46	12,95	14,03	15,07	14,58	16,74	14,39	14,65	8,46	
Energy dependency ratio	66,13	67,52	69,69	71,63	71,67	72,72	70,58	68,99	69,34	70,86	66,13

Source: Altıntaş H., "Türkiye'De Petrol Fiyatları, İhracat ve Reel Döviz Kuru

İlişkisi: Ardl Sınır Testi Yaklaşımı ve Dinamik Nedensellik Analizi”, Uluslararası Yönetim İktisat ve İşletme Dergisi, vol.9, no.19, pp.1-30

In Table 2, crude oil prices, oil, and energy dependency in Turkey 2000 - 2012 has been shown. In the world market, they sold crude oil at an average of 24.4 USD/barrel in 2001. Since 2009, crude oil has started to rise constantly because of the 2008 US Crisis that caused global contraction. When having look at the chart, between 2000-2012, it can be said that the prices rose 291%, the average was 61,37 USD. Crude oil import was more than 20 million tons when it comes to 2008, however, the natural gas usage increased and the import amount decreased after 2008.

Even though there was not an unusual rise in the import of crude oil, the increase of the oil price came to the level of the exchequer. In 2000, the oil bond was 4,2 billion dollars and in 2012 it went up to 16 billion dollars. Between 2000-2012, it was 116,8 billion USD oil import payment in total. On the other hand, between 2011- 2012, the percentage of payment for oil in the total income of export was 10 %. 2000 payments told that crude oil payment increase was 45% in 2004, 105% in 2005 and 284% in 2012. When taking this into account, in Turkey crude oil percentage within the total imports has not decreased since a new source of energy had not come up and, its energy dependency rose up to 70% as more than before. For the next years, both in energy demand and payment are foreseen increases.

3.1.4 Turkey’s Export and Import of Oil

Crude oil consumption is the most initial energy consumption of almost half of Turkey. Foreign oil producers present most of the need. As Turkey’s crude oil import is 9% and oil import causes of spending 2,27% of GDP. Export and import are dependent on each other in Turkey. So, export (car, durable and half-durable consumption goods) uses imported intermediate goods’ import (traded goods, goods, investment goods, vehicle parts traded not for the industry) as an input. As a conclusion, exporters who operate in the fabrication industry can echo the outlays of semi-finished and intermediate goods that are imported mostly within the export goods. Since there are demand and income flexibility at a high level, and medium technology comprehensive product, the relative rise in exports were not restrained, in spite of the oil prices.

3.2. Stock Market in Turkey

Borsa Istanbul, which is the organized market in terms of financial securities in Turkey,

organizes both secondary stock and bond market. Besides it, OTC markets which are not in the organized market but in a mutual deal of economy market members exist. However, OTC markets consider the price which exists in organized markets.

3.2.1. Secondary Bond Markets in Organized Markets

On June 1991, Borsa Istanbul (BIST) established a new organized market called Debt Security Market that trades government bonds. The Debt Securities Market consists of some sub-markets, such as:

- 1- Outright Purchases and Sales Market: it conducts debt securities' transactions which comprise government bonds.
- 2- Offering Market for Qualified Investors: "Qualified investors" who are given capital market instruments of the corporations who trade their equities on Borsa Istanbul Equity in this market.
- 3- Repo- Reverse Repo Market: Repo-reverse repo transactions are conducted.
- 4- Interbank Repo-Reverse Repo Market: Only banks conducts repo-reverse repo transactions for themselves.
- 5- Repo Market for Specified Securities: Repo-reverse repo transactions with particular debt securities are conducted.
- 6- Equity Repo Market: Companies' shares that are in BIST 30 Index are traded on Borsa Istanbul Equity, so in this market repo-reverse repo transactions are conducted together with them.
- 7- International Bonds Market: Borsa Istanbul lists and Turkish Undersecretariat of Treasury issues the foreign debt instruments, then they are traded in this market.
- 8- Negotiated Repo Deals Market: Preferred counterparties can conduct the repo-reverse repo transactions in this market.
- 9- Turkish Treasury publishes the government bond securities and they are traded in Outright.

In the Debt Securities Market, Borsa Istanbul's members' intermediary institutions, Central Bank and banks are permitted to generate their transactions. Borsa Istanbul members' agencies are used to generating their transactions for retail and corporate investors since they cannot by their own names. In total, even though eight sub-markets which include in Debt Securities Market, it has

a fundamental share in outright purchases and Sales Market which trade government bonds. So, in the total debt securities market, it has an important place of liquidity of the secondary market in the bond market.

Together with Merkezi Kayıt Istanbul- CSD of Turkey, Takasbank Settlement Pool Account conducts the process of settlement of the securities. The interlinked systems of Merkezi Kayıt Istanbul and Takasbank support Merkezi Kayıt Istanbul on an immediate echo of securities' transfer. Merkezi Kayıt Istanbul transfers the info in detail and it conducts the settlement realization.

Table 3: Primary Dealers in 2018

Akbank T.A.Ş.	ING Bank A.Ş.	T. İş Bankası A.Ş.
DenizBank A.Ş.	T. Ekonomi Bankası A.Ş.	T. Vakıflar Bankası T.A.O.
Deutsche Bank A.Ş.	T.C. Ziraat Bankası A.Ş.	Yapı ve Kredi bankası A.Ş.
QNB Finansbank A.Ş.	T. Garanti Bankası A.Ş.	
HSBC Bank A.Ş.	T. Halk Bankası A.Ş.	

Source: Turkish Treasury (listed in alphabetical order)

In Borsa Istanbul, Primary Dealership System which was presented by the Turkish Treasury in 2000 is one of the basic components of the secondary bond market. Since there was an economic crisis in Turkey in 2001, the system had not functioned until 2002, however, it has been functioning since 2002. The banks that are primary dealers in the system have got several advantages and mandatory things in terms of secondary and government bond market, throughout they aim to reduce roll-over risk, board investor base, create a transparent, well-organized, competitive secondary market, increase fluidness and dispose of oscillation in secondary government bond market. Each year, primary dealers make a protocol that Turkish Treasury signs. So, some advantages and duties are given to protocol owners.

Table 4: Advantages and Duties of Primary Dealers in 2018

Rights of PDs	Obligations of PDs
Using “Turkish Primary Dealer” title	On a monthly and quarterly basis, purchasing predetermined amount of the government securities in public auctions
Participating in public auctions without collateral	Enhancing secondary market fluidness through giving bid and asking quotations with PD title

Submitting non-competitive bids before the public auctions	Mandatory of research and sharing them with the Treasury
Submitting options bids letter than the public auctions in closed	Not deforming competition in the primary market through coordination with other PDs and /or attendants
Including is cash operations in the market	
Attending in “TAP” sales	
Serving as a mediator mentor in public offerings	
Attending in buy-back and switching public auctions carried out by the Turkish Treasury	
Attending in the meetings for Primary Dealership Consultation Board	
Trading at the Securities Lending Market at the Central Bank	

Source: Turkish Treasury

In the Turkish Treasury, the Primary Dealers system presents many advantages for the primary and secondary market. In the pie chart below, it is shown in the primary market, distributions of sales of government securities.

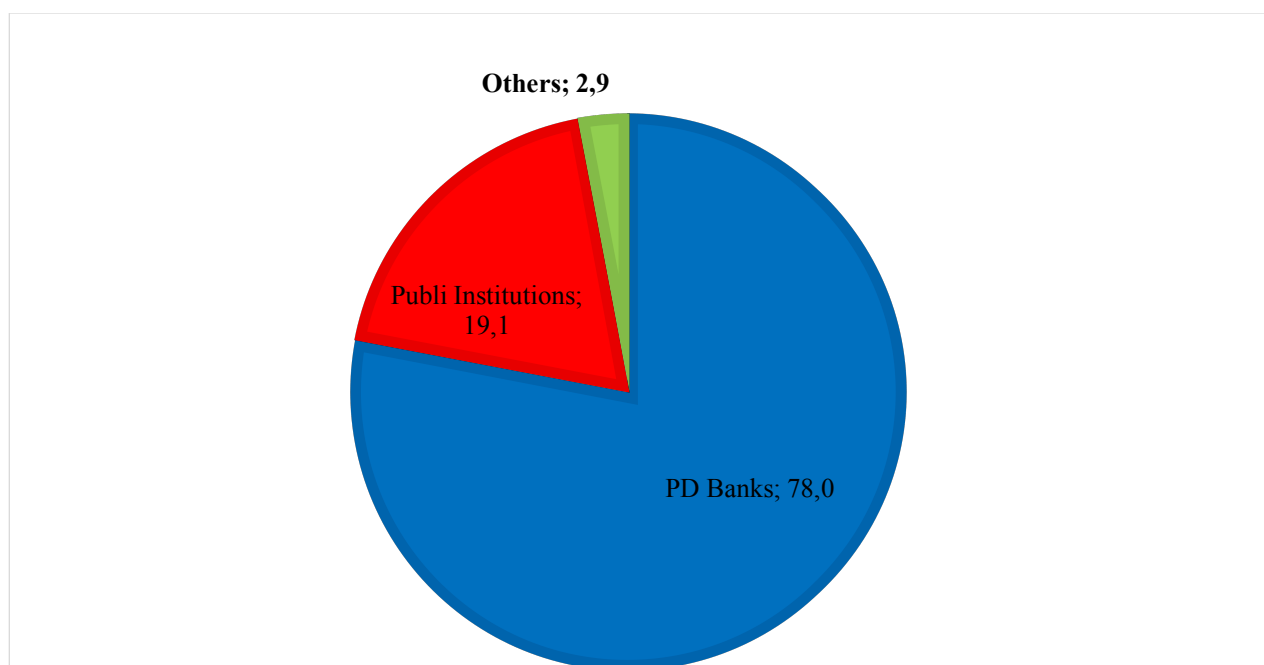


Figure 6: Distributions of Domestic Government Securities Sales in Primary Markets (2017).

Source: Turkish Treasury, 2018

As it is seen in the pie chart, PD banks conducted 78% of the total domestic loans in 2017. The secondary bond market has also important help from the PD Banks. As it was mentioned above, “Turkish Primary Dealer” title is given to PD Banks to use in Borsa Istanbul for their secondary market functions. Therefore, it can be separated that the if PD based secondary market transactions

are PD initiated or not.

3.2.2. Secondary Bond Markets in OTC Markets

In OTC (Over the Counter) market, it is possible to trade the debt securities, besides the organized markets, and each transaction which is done here is notified to the Borsa Istanbul. The bank accounts at the Central Bank, Takasbank or the system

of MKK (Merkezi Kayıt Kuruluşu) of Turkey conduct the agreement of OTC transactions. Banks or agencies which have got lines and line limits conduct the transactions in this market to the others. Most of the time, Debt Securities Market in Borsa Istanbul determines the organized market prices.

3.2.3. Secondary Bond Market in Borsa Istanbul

The secondary stock market covers their need for equities from the equity market under Borsa Istanbul. Besides the equities, there are traded certificates, exchange-traded funds, warrants, and rights coupons as well in the market.

The markets have the method of multiple-price continuous public auction. This system provides sell and buy orders that can be combined in price and time in order of priorities by itself. Within a single session, equity transactions are conducted. With the public auction (single price) is the starter of the session. Later, the orders are randomly registered in the T system. When the period is over, matching the orders and determining the opening prices are done. There is also a closing public auction when the session is over. Differently, short selling and short selling based transactions are done in the market. Before closing the day, Borsa Istanbul makes an announcement on their website and notifies transaction prices, securities and volumes.

Takasbank does the agreement of equities and cash with the system of the delivery versus payment (DVP).

3.3. Stock Market and Oil Prices

The oil which is one of the primary energy sources has a significant influence on the economy. First of all, the impact derives from the fact that the oil is used as an indispensable input for most of the sectors. Since it is important in terms of finance as well, it should be followed up in the change in oil prices. Especially, oil price increase causes foreign commerce imbalances in

oil import countries and directs the capital flow from oil import countries to oil export countries. Also, it causes the companies to raise the production costs and therefore the price level goes up in general. This increase also creates cost inflation and weakens the purchasing power, hence total demand narrows and investments get affected badly. Inflationist pressure is controlled by Central Banks through an interest rate hike. Since the increase in interest will direct the investors to the treasury bond and security, demand for the stock will decrease so stock prices will decrease as well. Besides, oil price fluctuations create economic risks and uncertainties and influence the economic units' expectations in a negative way.

Another influence of oil on the economy derives from that investors consider the oil as an investing tool as well as various tools. Economic units follow up the oil prices while making a decision about their investment. Since the oil price has a really important impact on economic activities and the stock market, and also considering as an investment tool, it is necessary for market actors to follow up the fluctuations.

On the other hand, for stock price fluctuations, the crude oil price change is considered as a significant element. There is a common sense that oil prices influence stock prices negatively.

According to the study which examines the effect of oil price on stock incomes in Norway between 1993-2005, 10% rise on oil prices raises stock income at a rate of 2,5%. So, there is a meaningful and positive correlation between stock and oil prices. According to another study which examines the effect of oil price on stock incomes, it is reasonable to find a positive and significant relationship for Norway, because Norway is an oil exporter country. On the other hand, for a lot of European countries oil price fluctuations cause reel stock incomes going back at a significant level. In Pakistan between 2007-2012, it is seen that there is a positive correlation between CPI and stock price (KSE) index and oil price. Olufisayo (2014) investigated that relationship for Nigeria over the period of 1981-2011, and found that oil price increases increase stock market return significantly but this relationship is valid only in the short run⁶⁰. On the other hand, Thorbecke (2019) differentiates oil price increase into two categories: oil price increase driven by supply, and oil price increase driven by demand. He found that it is only supply driven oil price increases that decrease stock market return significantly in US. However, this negative relationship held only

⁶⁰ Akinlo, Olayinka. (2014). Oil Price and Stock Market: Empirical Evidence from Nigeria. *European Journal of Sustainable Development*. 3. 33-40. 10.14207/ejsd.2014.v3n2p33.

until 2007 after which US remarkably increased its oil production⁶¹.

One of the studies which examined the relationship between oil prices and stock belong to İscan (2010). According to İscan (2010), there is no correlation between oil prices and price index of BIST100 stock. Güler et. al. (2010) claim that there is a long-term relation in stock prices, which are related with the energy sector, on the other side, in short term, there is a one-way causality relationship from oil price to stock prices. Another one, Kapusuzoğlu (2011) tested the oil price and BIST100, BIST50, and BIST30 index prices and concluded that each index and oil price has a long-term relation, in addition, in short term, there is a one-way causality relationship from stock prices to oil prices. On the other hand, Ünlü and Topçu (2012) did research on the impact of oil prices on BIST100 and indicated that oil prices affect stock market sector in a positive way, and BIST index quickly reacts for oil price fluctuations. Karhan and Aydın (2018) prepared a study examining oil prices and BIST100 through using daily data in Turkey between 2009-2018, and the study shows that only short-term causality relation exists from oil prices to BIST 100. According to the results of the asymmetric causality tests, there is no causality relation between oil prices and stocks. So, considering both results, it is reached that there is no long-term correlation between the two.

Oil which is the primary energy sources has an important effect on the economy. First one of the effects derives that oil is used as an indispensable input to many sectors. Since it presents an important cost component, a change in oil prices should be followed carefully. Increase in oil price especially causes balance change in oil-export countries' foreign trade, and it directs the capital flow from oil importing countries to oil exporting countries. On the other hand, the increase in oil price raises the production cost of the firms and causes rising up the general price level. Increase in oil price causes the purchasing power to weaken through creating cost inflation, then the decrease in purchasing power causes to limit the total demand and to have a negative effect on investments.

The inflationist pressure is controlled by the central banks through raising the interest generally. Since the increase in interest directs the stock investments to treasury stock and security, it causes to diminish the demand for the stock, so stock prices decrease. Besides, fluctuations in oil prices affect the financial units negatively by creating risk and uncertainties in the economy.

⁶¹ Willem THORBECKE , Oil Prices and the U.S. Economy: Evidence from the Stock Market, PRIETI Discussion Paper Series 19-E-003, 2019

Another effect of oil on the economy derives from that investors consider the oil as an investment tool besides the various alternative investment tools. While financial units make their decisions, they follow up oil prices at the same time. In general, since the oil has a great influence on economic activities and stock market via various channels, and is considered as an alternative investment tool, fluctuations in oil prices should be followed up by the market actors.

Since industrialization has been improving day by day, the oil comes up as a very important input for modern economies. While developed countries' energy production is high, energy use is more intense in the economy of developing countries. Besides this, most of the time it is not possible to replace the oil which is a very important input in developing countries' production process. This situation causes things to become more fragile and sensitive for those economies mentioned.

So, oil price changes that we face are often an effective point of view to understand the stock price fluctuations. It can be mentioned a lot of studies in analyzing the relation between oil and the stock market, and most of the analysis done discussed the causative relation between oil and stock price.

4. DATA AND METHODOLOGY

4.1. Data and Descriptive Statistics

In this paper, the monthly data from January 2002 to September 20019 is used. The main study of interest of our paper is the oil price's effect on Turkish stock index. Therefore as a proxy for dependent variable which is the performance of Turkish Stock Market, BIST 100 index is chosen. BIST 100 index is used as the main index for Borsa İstanbul Equity Market. It consists of 100 stocks selected among the stocks of companies traded on the BIST Stars and BIST Main markets and the stocks of real estate investment trusts and venture capital investment trusts traded on the Collective and Structured Products Market⁶². The independent variable of the study is oil price. To measure oil price Brent Crude Oil Price is chosen as independent variable. Brent Crude is the type of crude oil mostly used in Europe.

⁶² <https://www.borsaistanbul.com/docs/default-source/endeksler/bist-stock-indices-ground-rules.pdf?sfvrsn=14>

BIST 100 index is obtained from Yahoo Finance website⁶³. The Brent Crude oil price is obtained from the database of Federal Reserve Bank of St. Louis⁶⁴. Both of the foreign exchange rate and interest rate data are obtained from the database of Central Bank of the Republic of Turkey (CBRT).

On the other hand, there are also some factors that can have significant effect on both oil price and stock exchange index. In this study two of the most important factors' effects are controlled in investigating the oil price's impact on Turkish Stock Market. These factors include interest rate and exchange rate. Interest rate is one of the main drivers of investment. High interest rate reduces investing incentives by two channels. First, high interest rate increases cost of borrowing which is the main source to finance investment. Secondly, high interest rate increases the opportunity cost of investing, too. As the interest rate increases, investors become more likely to deposit their money to banks and earn interest income rather than take risk and make investment. The decreasing effect of high interest rate on investment does also cause the value of the companies to decrease. Similarly, by decreasing investment, high interest rate also decreases the demand for raw materials, and energy. This decreasing demand ultimately effects the main source of energy and raw material which is oil. Therefore, controlling the effect of interest rate on the relationship between oil price and stock exchange market is a critical condition.

Foreign exchange rate is another factor that can have significant effect on both oil price and stock market. A depreciation of currency can directly increase the energy cost of companies, and thereby it can also decrease the demand for oil. Moreover, depreciation of currency makes the value of companies relatively cheaper and thereby it can increase the demand for the companies. For this reason, foreign exchange rate is another factor which is added as control variable in the model. Interest rate is proxied by the weighted average interest rates applied to commercial and consumer loans extended by the Turkish lira to the banking sector, and for foreign exchange rate TL/USD exchange rate is used.

Other two factors whose effects are controlled is 2008 Global Financial Crisis and global growth economic growth. For 2008 Global Financial Crisis a dummy variable generated. This dummy variable takes the value of 1 for the months in 2008 and zero otherwise. Industrial index

⁶³ <https://finance.yahoo.com/quote/XU100.IS/>

⁶⁴ <https://fred.stlouisfed.org/series/DCOILBRENTU>

of Euro area is used. This data is obtained from OECD database, it is only available for Euro area which is the weighted average of 19 European countries.

Table 5 shows the descriptive statistics of the variables

Table 5: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probabilitiy	Observation
BIST_100	56.69	57.39	119.53	8.84	28.98	0.04	2.02	8.59	0.01	212
EXC_RATE	2,17	1.63	6.37	1.17	1.18	1.80	5.51	170.09	0.00	212
OIL_PRICE	69.15	65.94	138.40	19.07	28.87	0.31	2.06	11.12	0.00	212
INT_RATE	21.85	18.05	69.97	10.00	11.49	1.95	6.61	249.59	0.00	212
EURO_INDUSTRIAL_PROD	99.76	99.00	110.30	86.70	4.75	0.00	2.67	0.95	0.62	212

The descriptive statistics depict that all of the variables except industrial production index of Euro Area have highly fluctuated in the relevant period. While the minimum BIST 100 index in the period of study is as low as 8.84, it has reached as high as 119.52. Similarly, oil price has also had a similar distribution. While the average oil price is \$69.15, it increased maximumly to \$138.4 and decreased minimumly to \$19.07. Moreover, it is seen that except industrial production index all of the variables are normally distributed. Therefore, except industrial production index not the level form but the logarithmic form of the variables is used in the regression.

4.2. Methodology

In this section, the methodology used in this study is explained. Because the most critical issue with time series data is stationarity, we, firstly, mention unit root tests as a way to detect stationarity. Non-stationary data can be used in regressions as long as the variables are cointegrated. Therefore, after the unit root tests, the concept of cointegration is also explained. The part of cointegration is followed by the vector error correction model and Granger causality test.

4.2.1. Unit Root Test

Unit root tests are performed to determine the stationarity of the variables. If the variables are stationary, we can directly use them in our model with their level form. However, if they are not stationary, they can be used in their level form only if they are cointegrated. Using non-stationary variables which are not cointegrated end up with having spurious regression results.

Inferences based on coefficients and test statistics of spurious regression might be highly misleading and unreliable.

Cointegration might be possible if the non-stationary variables have the same degree of integration. So, by unit root test we can find out whether the variables are stationary. And if they are not stationary, the degree of integration of the variables can also be determined by unit root tests.

An economic time-series that follow a random walk process is called “non-stationary” over time. If it becomes stationary after differencing d times, that variable is then referred to as integrated of order d or $I(d)$. In order to test for unit roots, mostly, Augmented Dickey-Fuller (ADF) Tests are performed. The equation for the ADF test is as follows:

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_2 t + \alpha_3 \sum_{i=2}^p \Delta X_{t+i-1} + u_t$$

The null hypothesis of ADF Test is that $\alpha_1 = 0$, while the alternative hypothesis is $\alpha_1 < 0$. If the null hypothesis is not rejected, it is suggested that the variable X_t is non-stationary. If there is enough evidence to reject the null hypothesis, it shows us that X_t is stationary. In the equation above both constant drift (α_0) and time trend ($\alpha_2 t$) are included into the model.

Two other type of ADF tests which are ADF Test without drift and ADF Test with drift without time trend can also be conducted. These tests can be formulated as following

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_3 \sum_{i=2}^p \Delta X_{t+i-1} + u_t \quad (\text{ADF without time trend})$$

$$\Delta X_t = \alpha_1 X_{t-1} + \alpha_3 \sum_{i=2}^p \Delta X_{t+i-1} + u_t \quad (\text{ADF without time trend and drift})$$

Although, the equations are different in these two tests, the null hypothesis and alternative hypothesis are the same as the first test. The coefficient of X_{t-1} (α_1) is tested to check stationarity as in the first type of ADF Test. Thus, in all three cases, the hypotheses tested are:

$H_0: \alpha_1 = 0$, the series has a unit root, the variable is non – stationary, against

$H_1: \alpha_1 < 0$, the series does not have a unit root, the variable is stationary.

4.2.2. Johansen Cointegration Tests

Stationarity is the most desired characteristic for time series variable. However, in some cases, even the variables are not stationary at their level form, they can be used in their level form as long as those variables are cointegrated in their model. To determine whether dependent variable, independent variables, and control variables are cointegrated, Johansen Cointegration Test can be performed.

The general concept of cointegration between variables suggests that there exists a long-run equilibrium, a long-run relationship, between variables, as long as these variables are cointegrated. To detect that kind of possible long-run relationship among variables Johansen (1988) multivariate cointegration test is designed. This test is actually a likelihood ratio test based on VAR model that allows for possible dynamic interactions among variables⁶⁵. In the VAR model, each variable become dependent variable and the dependent variable's lagged values and independent variables' lagged values added to the equation. At the end, there will be as many equations as number of variables. So that each variable's effect on other variables can be tested. The VAR model, for two variables, will use the following systems of equations.

$$Y_t = \alpha_0 + \sum_{i=1}^m \beta_i Y_{t-i} + \sum_{i=1}^m \beta_i X_{t-i} + u_t \quad (7)$$

$$X_t = \alpha_0 + \sum_{i=1}^m \beta_i Y_{t-i} + \sum_{i=1}^m \beta_i X_{t-i} + u_t \quad (8)$$

The “m” in equations above refers to appropriate lag length. Before running the Johansen Cointegration Test optimum lag of ‘m’ should be determined. The appropriate lag length is chosen depending on the information criteria. The information criteria used in this study are Likelihood Ratio (LR) statistics, Final Prediction Error (FPE), Hannan-Quenn (HQ) , Schwarz (SIC), Akaike (AIC). The lower the model's information criteria, the more appropriate the lag length used in that model. However, solely information criterion is not enough to decide on optimal lag length. Serial correlation is a very critical problem in VAR analysis, because VAR model includes the lagged value of dependent variable. Therefore, before determining optimal lag, the model results with that lag should be tested in terms of serial correlation. The appropriate lag length can only be selected after finding that the error terms are not serially correlated.

⁶⁵ Damodar Gujarati, Basic Econometrics, 5th ed, U.S.A: Tata McGraw-Hill Education Pvt. Ltd, 2013, p.327.

4.2.3. Causality Tests: VECM and Granger Causality

Two of the analyses that are used in our study are the Granger Causality Test and Vector Error Correction Model.

Causality refers to the ability of one variable to predict (and thus cause) the other. If there is no cointegration between variables, the causality test should be applied. The Granger (1969) causality test which is developed for two variables can be written as the VAR model ⁶⁶:

$$y_t = \alpha_1 + \sum_{i=1}^n \beta_i x_{t-i} + \sum_{j=1}^m \gamma_j y_{t-j} + u_{1t} \quad (9)$$

$$x_t = \alpha_2 + \sum_{i=1}^n \theta x_{t-i} + \sum_{j=1}^m \delta_j y_{t-j} + u_{2t} \quad (10)$$

In these equations, it is assumed that both u_{1t} and u_{2t} are uncorrelated white-noise error terms. Thus, x does not Granger cause y if $\beta_1 = \beta_2 = \beta_3 = \dots = \beta_n = 0$ where the hypothesis is tested using the F test. If at least one of the coefficients of the lags of independent variable does not equal to zero, the null hypothesis that x does not Granger cause y should be rejected.

If there is cointegration, then causality can be examined using the vector error-correction model (VECM) (Granger, 1988) as below:

$$\Delta y_t = \alpha_o + \sum_{i=1}^n \alpha_i \Delta y_{t-i} + \sum_{i=1}^n \gamma_i \Delta x_{t-i} + \alpha_3 z_{t-1} + u_t \quad (11)$$

Where

$$z_{t-1} = \text{Error Correction Term (ECT)} = y_{t-1} - \beta_0 - \beta_1 - x_{t-1} \quad (12)$$

This model allows to test both short-term and long term causality between variables. The short-term causality of the VECM can be tested by aforementioned Granger Causality test procedure. The coefficients of the lags of the differences of the independent variable is shown by γ s. By using the Wald test, we can test the null hypothesis that $\gamma_1 = \gamma_2 = \gamma_3 = \dots = 0$ against at least one of the lags of differences of independent variable is significant. If the null hypothesis is rejected, the test suggests that there is a short-term causality between variables. On the other hand, if the null hypothesis that all of the lags of differences of independent variable are jointly zero

⁶⁶ BADARUDIN, ibid

cannot be rejected, this will show that there is not enough evidence to support any short run causality between variables.

VECM model does also allow to test the long-term causality among variables. Long-run relationship can be tested by examining the error-correction coefficient of α_3 . The hypotheses about α_3 are as follow:

$H_0: \alpha_3 = 0$, the variables do not have a long run relationship , against

$H_1 : \alpha_3 < 0$, the variables do have a long run relationship.

If α_3 is significantly less than zero, it shows that there is enough evidence for the long run relationship between dependent and independent variables.

5. DATA ANALYSIS AND EMPIRICAL RESULTS

In this study, the relationship between oil price and Turkish Stock Market is investigated. Firstly, the stationarity of the variables is determined so that it can be checked whether the conditions for cointegration between the variables of the model are satisfied. The unit root tests and cointegration tests suggest that there is cointegration relationship between the variables. Therefore, we used VECM analysis to interpret the long-run relationship between stock index and oil price. Additionally, by Granger Causality test on VECM model short run relationship between stock index and oil price is also tested.

5.1. Unit Root Test Results

The first two requirements for a cointegration are

- the variables of the model should be non-stationary in their level form and
- they should have the same degree of integration.

To determine whether the variables are stationary at their level form and whether they have the same degree of integration, we used Augmented Dickey Fuller unit root test.

Table 6: ADF Unit Root Test Summary

Variables	None	Intercept	Trend and Intercept
log_BIST100	1.37	-1.53	-2.16
log_oil_price	0.3	-2.73*	-2.46
log_exchange_rate	2.67	1.31	-0.9
log_interest_rateü	-1.26	-2.84*	-2.42
Euro Industrial Production	0.20	-2.65*	0.19

Variables	None	Intercept	Trend and Intercept
log_BIST100	-15.63***	-15.86***	-15.90***
log_oil_price	-11.86***	-11.86***	-11.92***
log_exchange_rate	-7.33***	-10.80***	-11.09***
log_interest_rateü	-8.55***	-8.59***	-8.72***
Euro Industrial Production	-5.435***	-5.42***	-5.434***

In the table the ADF test statistics are shown. * represents 10% level of significance, ** represents the 5% level of significance and *** represents the 1% level of significance. The first part of the table demonstrates the t values of ADF test statistics when the test is applied to level form of variables. In the second part of the table, the test statistics is shown when the test is applied

to first difference form of the variables.

The ADF test statistics for the level form of the variables suggest that the null hypothesis that the variables have a unit root cannot be rejected at 5% significance level. This implies that none of the variables are stationary at their level form.

The ADF tests with intercept suggest that the non-stationarity of variables can be rejected for logarithm of oil price and logarithm of interest rate but only at 10% significance level not at generally accepted 5% significance level.

After observing that none of the variables are stationary, the ADF test is applied for the first difference form of the variables to determine whether the variables have the same degree of integration.

As it is seen from the Table 6, the null hypothesis that the variables have unit root is rejected regardless of the type of ADF test even at 1% significance level. From the ADF test statistics it can be concluded that all of the variables are I(1).

5.2. Johansen Cointegration Test Results

After confirming that all of the variables are non-stationary and have the same order of integration, it should be tested whether there is a cointegration vector among the variables. However as explained in the methodology part of the paper, before running the Johansen Cointegration Test, the appropriate lag length for the model should be determined.

5.2.1. Lag Length Selection

To select appropriate lag length, the information criteria table is constructed as in Table 7.

Table 7: Information Criteria Table

Lag	LogL	LR	FPE	AIC	SC	HQ
0	577.8916	NA	2.63e-09	-5.567564	-5.404911	-5.501768
1	1814.280	2387.927	1.83e-14	-17.44392	-16.87464	-17.21364
2	1882.544	128.4976	1.20e-14	-17.86808	-16.89216*	-17.47331*
3	1905.079	41.31318	1.23e-14	-17.84391	-16.46136	-17.28464
4	1935.751	54.72893*	1.16e-14*	-17.89952*	-16.11034	-17.17576
5	1953.820	31.35520	1.25e-14	-17.83157	-15.63576	-16.94332
6	1967.243	22.63485	1.14e-14	-17.71807	-15.11562	-16.66533
7	1981.034	22.57848	1.58e-14	-17.60817	-14.59909	-16.39094
8	1998.124	27.14373	1.73e-14	-17.53063	-14.11492	-16.14891

As it is seen from the Table 7, mostly suggested lag length is 4. LR, FPE and AIC information criteria suggest that the appropriate lag length is 4. On the other hand, it should be also checked whether the model with 4 lag suffers from serial correlation.

3.1.1 Serial Correlation Test

The LM serial test results of the VAR model with lag 4 is illustrated in Table 8.

Table 8: Serial Correlation Test

Null hypothesis: No serial correlation atlags 1 to h						
Lag	LRE*stat	df	Prob.	Rao F-stat	df	Prob.
1	32.97927	25	0.1316	1.328960	(25,659.0)	0.1317
2	56.45679	50	0.2464	1.134755	(50,787.8)	0.2469
3	83.37224	75	0.2377	1.117882	(75,804.1)	0.2391
4	117.4394	100	0.1123	1.186872	(100,795.0)	0.1141
5	143.2971	125	0.1257	1.158460	(125,777.6)	0.1291
6	166.0432	150	0.1753	1.116185	(150,756.7)	0.1820
7	203.6545	175	0.0681	1.181636	(175,734.3)	0.0735
8	233.2948	200	0.0533	1.186596	(200,710.9)	0.0599

The LM test results suggest that there is no serial correlation at lags 1 to 8, because the p-value of the test statistics for lags 1 to 8 is 0.0599 which is greater than 5% significance level. Therefore, no serial correlation at lags 1 to 8 cannot be rejected. As a result of these findings the appropriate lag length for VAR model is chosen as 4. Based on the test results for cointegration test the appropriate lag length is chosen as 3. The lag length for cointegration is the lag length chosen from VAR model minus one, because in cointegration model first difference of variables are used not the level form as in VAR model.

5.2.2. Trace and Maximum Eigenvalue Test Results

The Johansen Cointegration Test results are depicted in Table 9.

Table 9: Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.201301	76.72168	69.81889	0.0127
At most 1	0.076228	29.74445	47.85613	0.7319
At most 2	0.033956	13.17279	29.79707	0.8836
At most 3	0.022861	5.952800	15.49471	0.7011
At most 4	0.005342	1.119453	3.841465	0.2900
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
*denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.201301	46.97723	33.87687	0.0008
At most 1	0.076228	16.57166	27.58434	0.6168
At most 2	0.033956	7.219990	21.13162	0.9447
At most 3	0.022861	4.833347	14.26460	0.7627
At most 4	0.005342	1.119453	3.841465	0.2900

Table 9 shows two types of cointegration test results. These tests are Trace Rank Test and Maximum Eigenvalue Rank Test. In both of the tests the null hypothesis for the first row is that there is **none** cointegration vector among the variables. The p-value of Trace Test is 0.01 which is less than 5% significance level. This suggests that the null hypothesis of no cointegration relationship should be rejected. After rejecting that there is no cointegration between variables, the second hypothesis is that there is at most 1 cointegration vector among the variables. The p-value of this second test is 0.7319 which is even greater than 10% significance level. This suggests that the null hypothesis that there is at most one cointegration vector cannot be rejected. As a result, Trace Test claims that there is one cointegration relationship between the variables. The maximum Eigenvalue test suggests that no cointegration relationship can be rejected at even 1% significance level, because the p-value of the test for no cointegration relationship is 0.0008. On the other hand, similar to Trace Test, Maximum Eigenvalue Test also does not reject the null hypothesis that there is at most one cointegration relationship between variables.

The results of Johansen Cointegration Test suggest that there is a long run relationship between the variables. Therefore, the VECM analysis is run to check both the long run and the short-run of the relationship between the variables.

5.3. Vector Error Correction Model (VECM) Analysis

The VECM analysis results are illustrated in Table 10.

Table 10: Vector Error Correction Model Regression Results

Vector Error Correction Estimates

Date: 06/26/20 Time: 15:45

Sample (adjusted): 2002M05 2019M08

Included observation: 208 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq 1				
LOG_BIST_100(-1)	1.000000				
LOG OIL PRICE(-1)	-0.257502 (0.06786) [-3.79480]				
LOG EXC RATE(-1)	-0.551335 (0.26228) [-2.10206]				
LOG INT RATE(-1)	0.902153 (0.14364) [6.28080]				
LOG(EURO)	-3.357843 (0.46039) [-7.29352]				
INDUSTR...	10.34607				
C					
Error Correction:	D(LOG BI..	D(LOG OI..	D(LOG E...	D(LOG IN...	D(LOG(EU..
CointEq1	-0.123574 (0.06119) [-2.01957]	-0.026746 (0.07045) [-0.37963]	-0.013687 (0.02453) [-0.55797]	-0.153735 (0.03271) [-4.70063]	0.007363 (0.00701) [1.01113]
D(LOG BIST 100(-1))	-0.050514 (0.09020) [-0.56115]	0.230008 (0.10385) [2.21471]	-0.103546 (0.03616) [-2.86350]	-0.077677 (0.04821) [-1.61119]	-0.000182 (0.01033) [-0.01759]
D(LOG BIST 100(-2))	0.020353 (0.09258) [0.21985]	0.039625 (0.10659) [0.37174]	0.018399 (0.03711) [0.49574]	-0.003574 (0.04948) [-0.07222]	0.019130 (0.01060) [1.80491]
D(LOG BIST 100(-3))	0.091831 (0.08511) [1.07897]	-0.208926 (0.09800) [-2.13196]	-0.048928 (0.03412) [-1.43395]	0.030924 (0.04549) [0.67977]	-0.012067 (0.00974) [-1.23837]
D(LOG_OIL_PRICE(-1))	-0.072387 (0.06347) [-1.14055]	0.118466 (0.07308) [1.62113]	-0.13239 (0.02544) [-0.52030]	-0.014967 (0.03392) [-0.44119]	0.011574 (0.00727) [1.59281]
D(LOG_OIL_PRICE(-2))	-0.019078 (0.06284) [-0.30358]	0.000885 (0.07236) [0.01223]	0.004941 (0.02519) [0.19613]	0.001259 (0.03359) [0.03748]	0.014286 (0.00719) [1.98563]
D(LOG_OIL_PRICE(-3))	0.012462 (0.06203) [0.20090]	-0.099473 (0.07143) [-1.39266]	-0.018115 (0.02487) [-0.72839]	0.044536 (0.03316) [1.34317]	0.004751 (0.00710) [0.66900]
D(LOG_EXC_RATE(-1))	-0.150312 (0.21254) [-0.70720]	0.178020 (0.24473) [0.72743]	0.365755 (0.08521) [4.29243]	0.422720 (0.11361) [3.72094]	-0.009890 (0.02433) [-0.40642]
D(LOG_EXC_RATE(-2))	-0.245832 (0.22030) [-1.11592]	-0.209876 (0.25365) [-0.82742]	-0.266214 (0.08832) [-3.01431]	-0.176726 (0.11775) [-1.50088]	-0.034165 (0.02522) [-1.35464]

D(LOG_EXC_RATE(-3))	-0.034028 (0.20930) [-0.16258]	-0.319783 (0.24099) [-1.32697]	0.077213 (0.08391) [0.92021]	0.076568 (0.11187) [0.68444]	-0.061743 (0.02396) [-2.57673]
D(LOG_INT_RATE(-1))	0.131079 (0.13323) [0.98388]	-0.053351 (0.15340) [-0.34779]	-0.77433 (0.05341) [-1.44976]	0.402429 (0.07121) [5.65126]	0.019149 (0.01525) [1.25546]
D(LOG_INT_RATE(-2))	0.130160 (0.14421) [0.90259]	-0.138208 (0.16604) [-0.83237]	-0.033180 (0.05781) [-0.57393]	-0.047144 (0.07708) [-0.61164]	-0.016068 (0.01651) [-0.97325]
D(LOG_INT_RATE(-3))	-0.212661 (0.11842) [-1.79581]	-0.035326 (0.13635) [-0.25908]	-0.034256 (0.04748) [-0.72155]	-0.019260 (0.06330) [-0.30428]	0.002758 (0.01356) [0.20342]
D(LOG (EURO INDUS..	-0.853955 (0.56752) [-0.50213]	-0.051199 (0.68767) [-0.07445]	-0.021109 (0.23944) [-0.08816]	-0.106269 (0.31923) [-0.33290]	-0.198036 0.06838 [-2.89627]
D(LOG (EURO INDUS..	-0.284970 (0.56752) [-0.50213]	-0.063792 (0.65345) [-0.09762]	-0.016271 (0.22752) [-0.07151]	0.414321 (0.30334) [1.36584]	0.062789 (0.06497) [0.96637]
D(LOG (EURO INDUS..	-0.117587 (0.54323) [-0.21646]	0.052916 (0.62548) [0.08460]	0.266872 (0.21778) [1.22541]	0.206422 (0.29036) [0.71092]	0.315504 (0.06219) [5.07301]
C	0.009270 (0.01811) [0.51200]	0.011114 (0.02085) [0.53314]	-0.006733 (0.00726) [-0.92760]	-0.041580 (0.00968) [-4.29659]	0.001736 (0.00207) [0.83761]
@TREND	0.000105 (0.00016) [0.65469]	-163E-05 (0.00019) [0.08808]	0.000120 (6.5E-05) [1.85248]	0.000347 (8.6E-05) [4.02972]	-3.72E-06 (1.8E-05) [-0.20149]
D2008	-0.118842 (0.02902) [-4.09551]	-0.080370 (0.03341) [-2.40548]	0.007073 (0.01163) [0.60801]	-0.022538 (0.01551) [-145314]	-0.008923 (0.00332) [-2.68603]
R-squared	0.124173	0.161921	0.318097	0.560798	0.333090
Adj. R-squared	0.040761	0.081104	0.253153	0.518969	0.269574
Sum sq. resids	1.271991	1.686345	0.204438	0.363401	0.016672
S.E. equation	0.082037	0.094459	0.032889	0.043849	0.009392
F-statistic	1.488672	2.028653	4.898077	13.40700	5.244243
Log likelihood	234.9441	205.6182	425.0639	365.2387	685.7420
Akaike AIC	-2.076385	-1.794405	-3.904461	-3.329218	-6.410981
Schwarz S C	-1.771514	-1.489534	-3.599590	-3.024347	-6.106109
Mean dependent	0.010262	0.003925	0.006989	-0.004807	0.000416
S.D. dependent	0.083762	0.098593	0.038057	0.063223	0.010989

As it is seen from Table 10, the error correction coefficient of the equation is -0.12 which is a negative number. This satisfies the first condition for a long-run relationship between the variables. However solely having a negative error correction coefficient is not enough to claim a long run relationship. The error correction coefficient should be significantly less than zero. The t-statistics of -2.01 shows that the null hypothesis that error correction coefficient is equal or greater than zero should be rejected. As a result, the VECM analysis shows that there is a long run relationship between BIST100, oil price, exchange rate and interest rate. The next step is to find out the sign, magnitude and the significance of the long-run relationship among the variables.

The first part of Table 10 depicts the cointegrating vector which shows the long-run relationship among the variables. The cointegrating vector suggests that there is a positive relationship between oil price and BIST 100 index. According to the results 1% increase in oil price increases BIST 100 by 0.257% in the long run. Moreover, the t-statistics of oil price is 3.79 which claims that the null hypothesis that oil price is not significant on BIST 100 in the long run should be rejected.

The cointegrating vector also suggests a positive relationship between exchange rate and BIST 100 index. 1% increase in exchange rate increases BIST 100 index by an average of 0.55%. This relationship is also significant at 5% significance level because the t-statistics of the coefficient of exchange rate is 2.10. Lastly, the findings show a negative relationship between BIST 100 index and interest rate in the long-run. 1% increase in interest rate decreases BIST 100 index by averagely 0.9 % in the long run. This relationship is also significant because t-statistics of interest rate is as high as 6.28%.

It is also seen that as expectedly 2008 Financial Crisis has a highly significant negative effect on BIST 100 index. In 2008 the average BIST100 index value is 12.4% lower than BIST 100 index value of other months of the relevant period.

The VECM analysis does not only provide estimation about the long-run relationship of the variables but also estimation about their short-run relationship. The second part of the Table 11 gives the findings about the short-run relationship among the variables. The short-run relationship of the variables are tested by Granger Causality Test. It is observed that neither oil price nor interest rate and exchange rate has significantly effective on BIST 100 index in the short run. While the t-statistics of oil price is -0.42, they are -1.34 and 0.38 for exchange rate and interest rate, respectively. All of the t-statistics are less than t-critical which is 1.96. Therefore, the VECM results do not suggest any significant relationship among the variables in the short run.

The short-run causality can also be checked by Granger Causality Test. The Granger Causality Test of VECM model is showed in Table 11.

Table 11: Granger Causality Test Results on VECM Model

VEC Granger Causality/Block Exogeneity Wald Test			
Date: 06/26/20 Time: 15:50			
Sample: 2002M01 2019M09			
Included observations: 208			
Dependent variable: D(LOG_BIST_100)			
Excluded	Chi-sq	df	Prob.
D(LOG_OIL_PRICE)	1.698648	3	0.6372
D(LOG_EXC_RATE)	2.553855	3	0.4656
D(LOG_INT_RATE)	4.707863	3	0.1945
D(EURO_INDUSTRI..	2.194754	3	0.5330
All	8.352759	3	0.7570

The Granger Causality Test results suggest that the null hypothesis that oil price does not Granger Cause BIST 100 index in the short run should not be rejected, because the p-value of the test statistics is 0.63 which is much higher than even 10 % significance level. Similarly, the null hypothesis that exchange rate does not Granger Cause BIST 100 in the short run cannot be rejected either, because the p-value of the test statistics is 0.46 which is again higher than 10% significance level. It is seen that interest rate does not Granger cause BIST 100 in the short run, either because the p-value of the test statistics of interest rate is 0.1945 which is greater than 10% significance level, too. Lastly, the industrial index of Euro area has again a p-value of 53.30% which is greater than even 10%. This also suggests that in the short run Euro industrial production index does not Granger Cause BIST 100 index.

In conclusion, the VECM model suggests that although there is a significant relationship between BIST 100 index, oil price, interest rate, exchange rate and industrial production index of Euro Area in the long run, in the short run this significant relationship cannot be observed.

CONCLUSION

The oil price is one of the most critical macroeconomic factors that can affect the economy of countries. Due to the fact that oil is the main source of energy for most of the countries, any fluctuation on oil price can affect the profits of companies and thereby their stock price. The effect of oil price has higher significance especially for the countries depending highly on imported oil for their needed energy. Turkey is one of these countries whose large share of imports consists of oil. In this study, we try to investigate the impact of Brent crude oil price on the performance of Turkish Stock Market based on a monthly time series from January 2002 to September 2019. After determining the existence of cointegration, the method of VECM analysis is run. The VECM analysis does not only provide to interpret the long-run relationship between oil price and stock market index but also it allows to test any possible short-run relationship among the variables.

Our findings claim that there is a significant relationship between oil price and Turkish Stock Market. The VECM results confirm the literature and suggest that oil price is positively significant on Turkish Stock Market. The relationship between interest rate and stock market index is as expectedly negative. It is found that increasing interest rate is a significant factor that decreases the stock market index. Moreover, it is also found that depreciation of Turkish Lira is one of the factors that promotes the performance of Turkish Stock. The industrial production index of Euro area is another factor that has significant effect on BIST 100 index. The findings claim that increasing the industrial production index of Euro area does significantly increase BIST 100 index. On the other hand, all of these relationships can be observed only in the long run. The Granger Causality Test results do not suggest any significance impact of oil price, interest rate, exchange rate or industrial production index of Euro area on BIST 100 index in the short run.

This study is constrained by BIST 100 index. Therefore, the sectors of the BIST 100 companies are not taken into account. For further studies the sectoral effect can be controlled. Because the effect of oil price on stocks can be different from sector to sector. For example, while for airline companies increasing oil price might have a highly negative effect, it might have a significantly positive effect on oil and gas companies. Moreover, besides using time series model, a panel data model consisting of companies historical stock price can be used so that some micro level factors like leverage of companies can also be controlled.

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