THE DEPARTMENT of ECONOMICS
YILDIZ TECHNICAL UNIVERSITY
ECONOMICS

MASTER's THESIS

THE IMPACT OF OIL PRICE SHOCKS ON THE ECONOMIC GROWTH: THE CASE OF TURKEY (2003-2018)

SELİN ÇİFTÇİ
13729007

SUPERVISOR
Associate Prof. Dr. SENEM ÇAKMAK ŞAHİN

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	Dr. Öğr. Üyesi Selda Görkey	

İSTANBUL
JULY 2019

ABSTRACT

THE IMPACT of OIL PPRICE SHOCKS on THE ECONOMIC GROWTH: THE CASE of TURKEY (2003-2018)
Selin Çiftçi
July, 2019

Oil has been the most important energy source for countries since the mid-1950s. It has a substantial role in different areas. It is used in oil based industries in addition to raw material usage. Therefore oil demand is significantly large. Its efficient substitute could not have been also found. Hence, it has an important role in economic activity. Since the late 1970s, fluctuations due to increase in crude oil and petroleum products' prices have been the subject of research in order to explain that chronic and high inflation in Turkey for many years. Also, it has both direct and indirect effects on Turkish economic growth rate. Since crude oil is a basic energy source, positive and negative shifts in oil prices have important effects on two main areas: inflationary effects of high oil prices and implications on fiscal policies as an oil importing country. This study examines the relationship between oil price shocks and economic growth in Turkey during 2003-2018 period. The purpose is to analyse how oil price shocks affect economic growth in Turkey. It adopts a Vector Autogressive Model (VAR) model. The varibles employed are: Real Gross Domestic Product (y), Consumer Price Index and oil price. Quarterly data were used between the period 2003Q1 to 2018Q4 and were taken from EDDS (Electronic Data Delivery System). The econometric methods were used in this study: unit root test, Johansen cointegration test, Granger causality test. The results show that there is one-way strong causality from oil prices to inflation, a weak one-way causality from inflation to growth and a weak causal relationship from growth to oil prices.

Key Words: VAR, Macroeconomy, Oil Price

ÖZ

PETROL ŞOKLARININ EKONOMİK BÜYÜMEYE ETKİSİ
TÜRKİYE ÖRNEĞİ (2003-2018)
Selin Çiftçi
Temmuz, 2019

1950'lerin ortalarından bu yana petrol, birçok ülke için en önemli enerji kaynağı olmuştur. Hammadde olarak kullanımının yanı sıra yağ bazlı endüstrilere kadar birçok farklı kullanım alanı mevcuttur. Talebi yüksek olması sebebiyle etkili bir ikamesi de henüz bulunamamıştır. Dolayısıyla ekonomik aktivitede önemli bir rolü vardır. 1970'lerin sonlarından bu yana, ham petrol ve petrol ürünleri fiyatlarındaki artıştan kaynaklanan dalgalanmalar, Türkiye'de uzun yıllardır süren kronik ve yüksek enflasyonun açıklanmasında araştırma konusu olmuştur. Ayrıca, Türkiye'nin ekonomik büyüme hızı üzerinde hem doğrudan hem de dolaylı etkileri vardır. Ham petrolün temel bir enerji kaynağı olması nedeniyle, petrol fiyatlarındaki olumlu ve olumsuz kaymalar iki ana alanda önemli etkiye sahiptir; yüksek petrol fiyatlarının enflasyonu artırıcı etkisi ve petrol ithal eden bir ülke olarak izlenen maliye politikaları. Bu çalışma, 2003-2018 döneminde Türkiye'de petrol fiyat şokları ile ekonomik büyüme arasındaki ilişkiyi incelemektedir. Amaç, petrol fiyat şoklarının Türkiye'deki ekonomik büyümeyi nasıl etkilediğini analiz etmektir. Vektör Otoregresyon Modeli (VAR) modeli benimsenmiştir. Kullanılan değişkenler: Gayri Safi Yurtiçi Hasıla (y), Tüketici Fiyat Endeksi ve petrol fiyatıdır. Üç aylık veriler 2003 yılı 1.çeyrek-2018 yılı 4.çeyrek dönemleri arasında kullanılmış ve EVDS'den alınmıştır. Birim kök testi, eşbütünleşme testi, granger nedensellik testi uygulanmıştır. Petrol fiyatlarında enflasyona doğru tek yönlü güçlü, enflasyondan büyümeye doğru tek yönlü zayıf ve büyümeden petrol fiyatlarına doğru zayıf bir nedensellik ilişkisi olduğu görülmektedir.

Anahtar Kelimeler: VAR, Makroekonomi, Petrol Fiyatları

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İstanbul; July,2019 SELİN ÇİFTÇİ

TABLE OF CONTENTS

LIST OF TABLES

Page Number

LIST OF FIGURES

Page Number

1. INTRODUCTION

Oil has been the most important energy source for countries since the mid-1950s. It supplies energy to power industry, heats homes, and provides fuel for vehicles and airplanes for carrying goods and people all over the world. In the United States, for instance, forty percent of the nation's energy need is supplied by oil. Also, oil's by-products are used for building motorways and producing many daily goods like ruler, CDs, glue etc. In addition to its raw material usage, oil-based industries create employment opportunities for people and boost the economic activity. When these are taken into account, it can be easily argued that oil is a big game changer in our lives.

It is clear that demand for oil is large and its efficient substitute could not have been found for now. On the other hand, since it is a natural and limited resource, it is only supplied by some certain countries where oil reservoir exists. Although oil market is not monopolistic, it is an example of an oligopolistic market. The United States is the major oil producer which is followed by Saudi Arabia and Russia. (BP Statistical Review of World Energy, 2018) More importantly, the Organization of the Petroleum Exporting Countries (OPEC) was established in 1960 and it currently represents 81.89 percent of total proven oil reserves in the world (OPEC, 2018, 6). The main oil suppliers such as Saudi Arabia, Venezuela and Iraq are members of the OPEC and they cooperate in determining aggregate oil they supply. Since the OPEC is the biggest player in the market, its cooperative decision-making mechanism is highly deterministic in oil supply.

As a very fundamental rule of economics, oil price is determined by supply and demand. Since 1950, the oil price has had ups and downs as a result of some demand and supply shocks. Until 2000s, it was thought that oil price changes were only driven by exogenous supply-side forces such as conflicts in the Middle East. However, Barsky and Kilian (2001, 151) challenged this idea by showing the importance of the demand-side. Also, they demonstrated that some endogenous factors may determine oil price in addition to exogenous supply-side factors.

Change in oil prices results in with important consequences on the world economy. Since oil is one of the fundamentals in our lives, changes in its price affect people inevitably. For example, Jimenez-Rodriguez and Sanchez showed in their paper that the increase in oil prices cause a slowdown in economic activity as production costs increase Jimenez-Rodriguez and Sanchez (2004, 9) Also, the volatility of oil prices is another factor that limits the economic activity.

2. HISTORICAL OVERVIEW OF OIL SHOCKS

First, historical summary of oil shocks will be presented in this study. Details will be discussed in five distinct petroleum shocks since 1970. Then, referring to various scholarly papers, will be explored the causes and impacts of changes in oil prices including transmission channels.

An oil shock can simply be defined as a sudden increase of oil prices because of a sudden decreased supply (Kilian et al., 2014, 469). Especially in the second half of the twentieth century, many oil shocks have occurred and in this study the most important ones would be researched and analyzed. The first oil shock occurred in 1973 as a result of the OPEC embargo to the United States. The second was centered around Iran in 1979 whereas third oil shock in 1990 was held due to the Iraqi invasion of Kuwait. The fourth one cannot be attributed to a specific event, instead, it was a ten-year process. Finally, nowadays, the world is faced with an oil price boost after prices plumbed the depths in 2016.

2.1. The First Oil Shock (1973-1974)

In the literature that would be seen the first oil shock has centered in the OPEC embargo to the United States in 1973. The Arab members of the OPEC decided to stop exporting oil to the USA and because of this reason the prices of oil have been increased excessively four times in the market.

The Arab countries had used oil as a tool to take advantage in politics. The first example of this political scene was the Suez Crisis in 1956 as a result of the invasion of Egypt by the UK, France, and Israel. At the beginning of the 1970s, President Nixon of the USA induced the OPEC embargo by taking the United States off the gold standard. It was against the Bretton Woods Agreement and his move depreciated the US dollar drastically. The depreciated value of the US dollar damaged the OPEC countries because their oil contracts were denominated in terms of the US dollar. The value of USD has decreased too much and this caused a huge loss of income for OPEC countries. On the other hand, the last drop of glass was the support of the USA to Israel for the Yom Kippur (or Ramadan) Battle against Egypt. President Nixon requested about $2.2 billion from the Congress to support Israel

army. The Arabic associates of the OPEC were frustrated by that move and decided to stop exporting oil to America and Israel. (Hamilton,2011, 14)

There are important academic works on the reasons of the first oil shock. In his article, Cyrus Bina divided theories on why the first oil shock occurred into three categories: traditional views, dependency theories, and conspiracy views (Bina, 1988, 331). In general doctrine it can be seen that the oligopolistic structure of market, collective decision making of the OPEC, and the supply and demand in the international market influence the changes. Traditional theorists often refer to such notions of the oil market, the collective. The main emphases of traditional theorists are the law of demand and supply (Vernon, 1975, 2), price setting ability of the OPEC (Penrose, 1975, 51), dependency of the United States on foreign oil (Mckie 1975, 77) and inability to adjust as a result of instantaneous price changes (Blair, 1976, 553). The majority of the traditionalists considered "OPEC-determined" prices and the dependence of the US on foreign oil as the most important causes of the first oil shock. Cyrus Bina had some misconceptions and because of this situation he had criticized the traditional approach. He said that crisis was not an objective process. Out of these, the basic argument of the dependency theorists is that there is an "OPEC offensive" against the industrialized countries of the West. The hypothesis say that OPEC countries are trying to have their self-determination and sovereignty by doing this offensive. The "offensive" is thought to be a response to the extensive domination that existed between Imperialist countries and the Third World countries. It is a kind of reaction to the unequal relations and exchange of trade between these countries. Therefore, the first oil crisis is a result of the political decision according to dependency theorists. Girvan (1975, 155) and Tanzer (1974, 171) were the main contributors to this theory. Cyrus Bina states that the main drawback of this theory is eclecticism, i.e., putting all the arguments of a general political and economic nature on an equal footing without seeking to determine their structural relationship or to single out the specific underlying causes of the oil crisis. Lastly, conspiracy theorists argue that the United States government collaborated with the international oil companies and caused the first oil crisis intentionally. The main motivation of the United States was to damage its main trading rivals Europe and Japan. However, it should be noted that the USA was one of the primary customer of the oil market and it always had a huge import rate in the oil market. Also it should be said that Europe

and Japan were more sensitive about the price changes of oil because those countries were importing almost all of oil from outside. The major deficiencies of these theorists are heavy dependence on the balance of trade and impossibility of empirical evidence, according to Cyrus Bina. He does not deny that increasing oil prices would affect Europe and Japan more but thinks that the causes of price changes unless one assumes that oil prices are determined monopolistically. Also, conspiracy claims cannot be proved or disproved by a neutral analysis. (Bina,1988, 335)

Cyrus Bina develops an alternative theory, which reflects the internal development of the international oil industry, on the oil crisis. In his view, the first oil crisis was a consequence of the internationalization process in the oil industry, which united all the oil-producing regions as a whole.

Until now, the reasons for the first oil crisis in 1973 have been analyzed. Furthermore, post-crisis environment is an important issue to tackle. The oil crisis resulted in a recession in the world. According to the World Bank, the GDP growth of the world was 6.57 percent in 1973 but it declined to 2 percent and 0.71 percent in 1974 and 1975, respectively. Therefore, the contractionary effects of increased oil prices were seen approximately after two years. The economies of the United Kingdom, the United States, and Japan shrunk drastically post-crisis era. Low growth brought increasing unemployment rates in coming years after the crisis. Also, inflation rates in these countries reached to double digits although the economies contracted. The world came up with a new term with the simultaneous realization of negative growth and high inflation: stagflation. Stagflation can be defined as an economic situation when the inflation is high, positive economic growth is low and there is an increase in the unemployment rates. (Öztürk et al., 2017, 6).

2.2. The Second Oil Shock (1979-1980)

Shortly after the first oil shock, the world confronted a new oil crisis which was again centered in the Middle East. In 1979, the Iranian revolution, which transmitted Iran from a monarchy to an Islamic republic, took place. The strikes all over Iran also spread to the oil sector and as a result, the oil production in Iran decreased drastically, namely by 4.8 million barrels/day or by 7 percent of the global oil production. (Hamilton, 2011, 16) Also, the war from 1980 to 1988 between Iran and Iraq and hostage crisis accelerated the oil crisis. The price of crude oil more than

doubled in twelve months after January 1979. Furthermore, prices peaked at $39 which was 160 percent more than the pre-crisis level. On the other hand, the most important factor that made the prices double was not the supply deficit. Since people were worried about oil because of the prior oil crisis, there were strong speculations on further oil drought. This generated a spurious price shock for oil. Moreover, some countries stored up barrels of oil in order to avoid a possible oil crisis. The booming economy of the world was another demand factor that made the prices climb up. Therefore, these demand based factors pushed up the price of oil more than it should be on top of the supply disruption of Iran.

The unpredictable disruption of oil production suited the OPEC countries' agenda and they avoided to produce the amount of oil cut by Iran. Only about one-third of the disrupted Iran oil was produced by other OPEC countries. Although long-term plans and their strategies are increasing the expense of oil at rate of the growth of industrialized countries, they disregarded it and allowed for a huge price increase. The reason was simple: the price increase in oil boosted their revenues and they did not prefer to lose it in the short run. It can be said that the demand of the other countries for the OPEC oil is inelastic for a short run. Although the demand for oil would decrease all over the world, they believed that they could recover the demand loss with a small price decrease in the following years. The real oil price had increased by five times from 1973 to 1980, while the OPEC countries were selling the same amount of oil, which means they increased their revenues excessively. (Gately, 1995, 5)

When the second oil shock came into effect, OPEC countries were the real winners in the short run because they clearly increased their profit. In powerful countries which are industrialized like the USA, long gasoline queues were the story again. Unpleasant memories from 1973 blazed the panic buying of gasoline. Just like the previous one, the crisis showed its effects on the growth after about two years. Worldwide economic growth gradually decreased from 4.1 percent in 1979 to 1.9 percent in 1980 and reached its minimum in 1982 at 0.4 percent. (Worldbank, 1982, 16). The biggest economy of the world, the United States have been affected severely. The US economy shrunk by 1.9 percent in 1982 in parallel way to the world. The unemployment rate jumped to 10 percent level in 1982 from around 6

percent in the pre-crisis period. Inflation was also a major problem, it exceeded the double-digit levels during crisis years.

In the short run, although OPEC countries gained a lot of profits, in addition to the previous one, this crisis taught the industrialized countries to adjust against the OPEC-based crises. In his paper in 1995, Dermot Gately argues the pricing strategy of the OPEC between the 1970s and the 1980s and its consequences. Despite the success of the price increase in the short run, the OPEC prompted several countervailing factors that made the demand for the OPEC oil decrease. Industrialized countries found alternative ways such as using oil from Alaska, North Sea etc. Also, they used alternative sources instead of oil to continue economic activities. For instance, to produce electric power, they started to use natural gas and nuclear power. (Gately, 1995, 7) Consequently, OPEC countries had a significant market share loss from two thirds to one half. In contrast to their long-term goals, they commenced increasing their yearly production by twice of the world growth rate, namely 5.6 percent during 1985-1995 so as to capture their market share. However, they could not manage to reach their goals and came out as a losing side at the end of the period.

There are several reasons explaining why OPEC countries actions discussed in the paper. Firstly, it is argued that the heterogeneous structure of the OPEC does not allow for agreement on a medium or long-term plan. Instead, OPEC countries are generally interested in short-term earnings. (Al-Chalabi, 1992, 43). The second reason mainly concerns the biggest oil producer in the OPEC, Saudi Arabia. Saudi Arabia was under pressure by other Arab countries to keep itself away from the United States. Saudi Arabia has obeyed the output restriction action because they did not want to offend the new generation regime of Iran and Iraq (Moran, 1981, 257).

2.3. The Third Oil Shock (1990)

The next oil crisis was also originated on the Middle East. The Gulf Battle of the major oil suppliers Iraq and Kuwait was the main cause of the crisis. Oil prices doubled in a very short time in 1990. The told crisis had ended under the guidance of the United Nations and the United States.

Independence of Iraq had not been supported by Iran since 1961, because they claimed that Kuwait should be their own territory. A couple of invasion attempts were prevented by other Arab countries before 1990. During the war between Iraq and Iran, Kuwait supported Iraq due to its fear of the Iranian revolution and paid $14 billion to Iraq as a financial assistance. At the end of the war, Iraq did not pay back this financial support by claiming that Kuwait also benefited from keeping Iran away and asked Kuwait for forgiving the loan. Yet Kuwait officials did not give an inch to forgive the loan. Therefore, the relationship between the two countries became even more strained (Hinnebusch, 2003, 200-219).

After the war, an offer from Iraq, which included to decrease oil production, was declined by Kuwait and they raised its oil production on the contrary. This move was perceived as an aggression by Iraq because decreasing oil prices damaged Iraqi economy. Also, Iraq claimed that Kuwait used slant-drilling technology to take away Iraq oils. All the sequence of incidences resulted in invasion of Kuwait by Iraq on 2 August 1990. The invasion provided Iraq 20 percent of the global oil supply. Immediately after the invasion, the United Nations Security Council opposed it and requested Iraq to withdraw its troops from Kuwait but, of course, it was rejected. In response, the United Nations Security Council started to implement a trade ban towards Iraq. As a consequence of the trade ban, oil supply in the world was cut suddenly (Quigley, 1992, 7; Verleger, 1990, 15)

Iraq's invasion of Kuwait made oil consuming countries worried at first due to the supply disruption. However, other producer countries agreed on increasing their output to replace the lost crude oil. Nevertheless, this did not prevent oil prices from increasing. According to Philip K. Verleger (1990, 21) there are four main reasons for the price increase in spite of healing by the other suppliers. First, the quality of Kuwaiti and Iraqi oils were different from the replacement oil. While the Iraqi and Kuwaiti oils have 30 degrees of gravities on average Saudi and Venezuelan have 28 and 16, respectively. Second, the high-tech refining centers in Kuwait were closed after the invasion and the embargo. They were very comparable with the centers in the West in terms of technology. Prior to the invasion, Kuwait was refining 800,000 barrels of oil per day. The report released by the OECD shows that between 50 and 60 percent of the refined oil in Kuwait was exported. Therefore, passivation of the refining centers triggered the price increase. Third, the demand for oil increased due

to the military actions in the Gulf. Followed by the invasion, demand for jet fuel increased by 5-7 percent and jet fuel prices skyrocketed by about 150 percent. Finally, uncertainties in the Middle East entailed precautionary stocks to increase. Oil companies commenced to stock barrels of oil due to the uncertainty in the market. (Verleger, 1990, 25).

The global economic setting in 1990 was marked by the crisis in the Middle East and the associated developments in oil prices. The direct effects of the doubled oil prices that followed the crisis in the Middle East were relatively small for the majority of industrialized and developing countries, comparing to the previous oil shocks. The main reason behind it is that the increase was short-lived, with the return of the prices to the pre-crisis level. The temporary rise in oil prices is estimated to raise the level of consumer prices by 0.5 of 1 percent and reduced the level of GNP by 0.25 of 1 percent. (International Money Fund Annual Report, 1991, 16). However, the indirect effects such as a rise in uncertainty in business environment might have slowed the output growth. Iraq and Kuwait were, as a natural result, the most negatively affected developing countries. On the other hand, some oil-exporting developing countries like Ecuador, Nigeria and Venezuela benefitted from this crisis because they captured the market share of Iraq and Kuwait.

2.4. The Fourth Oil Shock (2002-2008)

After the crisis in 1990, when the oil price increased to the $40 per barrel level, crude oil price remained under the $25 level until 2002. It reached the rock bottom in 1998 as $11 per barrel. However, after 2002, oil prices started a continuous increasing trend. Just before the mortgage crisis in the United States, crude oil price reached the level of $140. Although there was no identified a specific development behind this increase, it was such a period that the oil crisis took place in the world definitely. In 2003, crude oil price overshot $25 level and mounted over the $78 per barrel until 2006. It skyrocketed, as mentioned, in 2008 above $140. Several reasons will be presented why oil prices had risen in such a manner (Wakeford, 2006, 102; Baumeister et al., 2016, 147)

First of all, it is appropriate to mention supply-side effects. After a sharp decline in 2001 as a result of the terrorist attack on the United States, the oil prices started rising. In 2002, output restriction by the OPEC, the disorder in Venezuela, and

conflicts in the Middle East triggered the rise in oil prices between January and June. The United States was expected to invade Iraq because of the terrorist attack and the oil fields in Iraq were anticipated to close down. Therefore, the oil supply was supposed to be cut and this anticipation increased the prices. Also, the continuing unrest in Venezuela and cold winter conditions in the United States contributed to the raise until the end of 2002. However, the United States did not completely close down the oil fields in Iraq, the oil supply continued to be the same, so the prices decreased to $25. After that, OPEC countries decided to reduce their production ceiling by one million barrels per day which stimulated the prices upwards. In October 2004, the crude oil price reached $50. Also Hurricane Ivan has damaged energy producing centers in Mexico and the US energy (for gas and oil) supplies have been interrupted. This increased oil prices over $65. The output restrictions implemented by Nigeria and Iraq raised the oil prices. The other hurricanes after Ivan exacerbated the price increase. At the beginning of 2006, Nigeria shut in more than 600,000 barrels of oil production and the OECD countries continued to cut their oil production. As well, the conflict between Israel and Lebanon escalated the turmoil in the Middle East. Although some other exporting countries balanced the lost production, total oil production in these years stagnated. Rather than significant supply disruptions, failure to produce was the main contributor to the price increase between 2005 and 2007. (Hamilton, 2009, 224). These developments combined with the expectations of the market because of some reports on the extinction of oil; oil prices approached to $100 in 2007. Therefore, a supply-side pressure gave a rise to the oil prices in these ways (Kilian, 2016, 147)

On the other hand, the demand was an even stronger factor for increasing oil prices. Especially China was using oil about 7 times more than before (Hamilton, 2009, 225). According to International Money Fund Annual Report World Economic Outlook: October (2008, 274) published by the International Money Fund, the world economy grew by 9.4 percent between 2004 and 2005. Considering the income elasticity of demand for petroleum, it is appropriate to attribute the growth in oil consumption, 6 percent, in the world entirely to the growth in the world income. Therefore, the upward-shifted demand curve was an important driver of rises. At this point, it is important to mention about China along with India. Till to 2000s and especially in 90s, China was a really rich and huge oil exporter of the world. After

2000, Chinese economy's magnitude relative to the world became even larger. Therefore, oil demand by China made a huge differential compared to the past. For instance, China achieved a 4.9 percent growth between 2004-2007 while it was 2.9 percent until 2000. (Hamilton, 2009, 227) Also, economic growth of India continued persistently and their large population was a natural reason for high oil consumption. As countries develop, industry and urbanization drive up the energy use, thus, China was the main contributor to the world petroleum demand increase. The same story was valid for India as well. Considering the stagnated world oil production, increasing demand pushed the prices upwards also.

Finally, the role of speculations cannot be undervalued in addition to demand and supply effects. In 2008, the manager of a financial fund, Michael Masters, stated that many investors bought oil not for a commodity but for a financial asset. These investors caused the oil market to be speculative. Therefore, speculations were one of the additional reasons for the oil price increase.

In the United States, high oil prices resulted in an average of 3.3 percent inflation in 2005-2006, clearly more than the long-term average of the country. Thus, the Federal Reserve implemented a contractionary monetary policy, namely increased the interest rates step by step, in order to keep down the inflation. On the other hand, not only its high level but also its volatility after 2000 was considered one of the drivers of the financial crisis in 2008. It is claimed that the investment risks emerged as a result of volatility led Wall Street to prefer self-interested cashing out to protect the shareholders. Moreover, the rise in oil prices pushed up the price of many petroleum-based fertilizers, which was the main driver of the world food price crisis in 2008 (Hamilton, 2009, 266)

In fact, high oil prices mostly affected the developing and the under-developed countries. Especially, in such countries, petroleum is mostly used for electricity and transportation. Here, South Africa can be given as an example for the economic balance. A raise of oil prices can cause financial problems in a market. It can be seen that an increase about 125 percent of the oil prices has caused about percent decrease in GDP. Also it influenced to reduce the household consumption by nearly 7 percent. The adverse effect of the oil shock was felt by the poorer segment of the formal labor market in the form of declining wages and increased unemployment. (Essama-Nssah et al., 2007, 523)

2.5. The Current Oil Shock

After 2014, crude oil price started to decrease expeditiously, by 50 percent in six months. In 2016, it was at the bottom of the last 13 years, below 30$ as a result of oversupply. However, it has been increasing for two years. Recently, it strikes the $80 level per barrel. There is not a particular event in which the current shock is centered. It is widely discussed that what the drivers of the price increase are. However, there are several incidents on which authorities agree.

Crude Oil Prices 1861-2018

Us dollars per barrel, world events

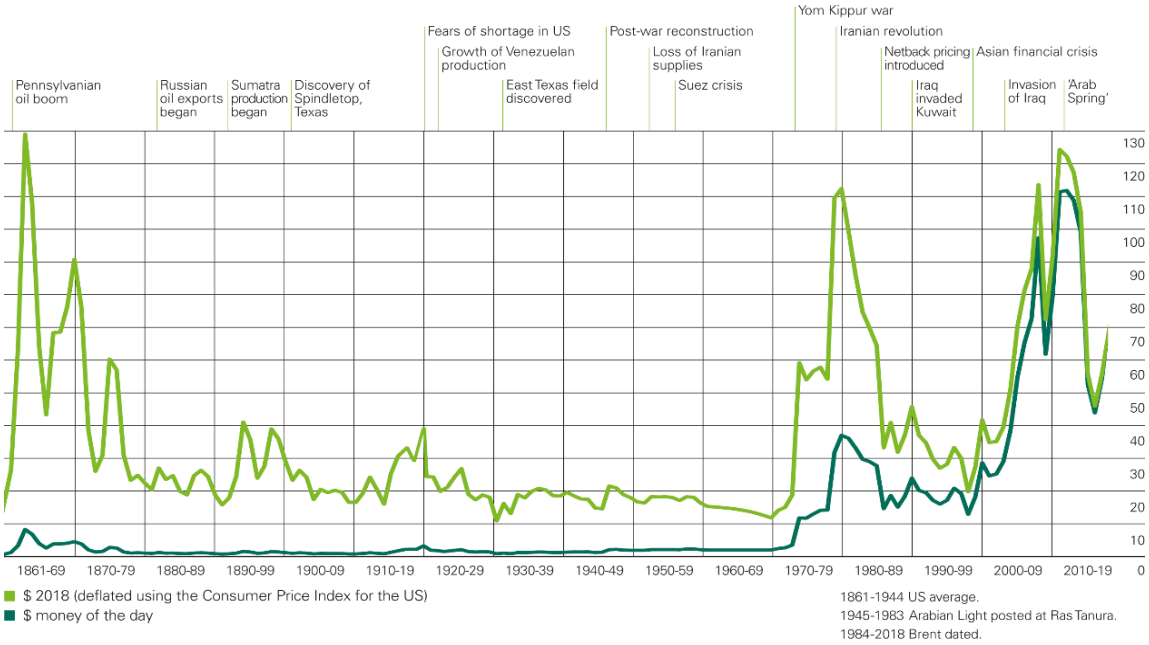


Figure 1: Crude Oil Prices 1861-2018

Source: BP Statistical Review of World Energy 2018, June 2018 67th Edition, data accessed 10 May 2019

As seen in the table below, the oil prices between the period 1970 to 2015. It is obvious that oil price increases was mostly increasing parallel to political events

Crude Oil Spot Prices

Us Dollars Per Barrel

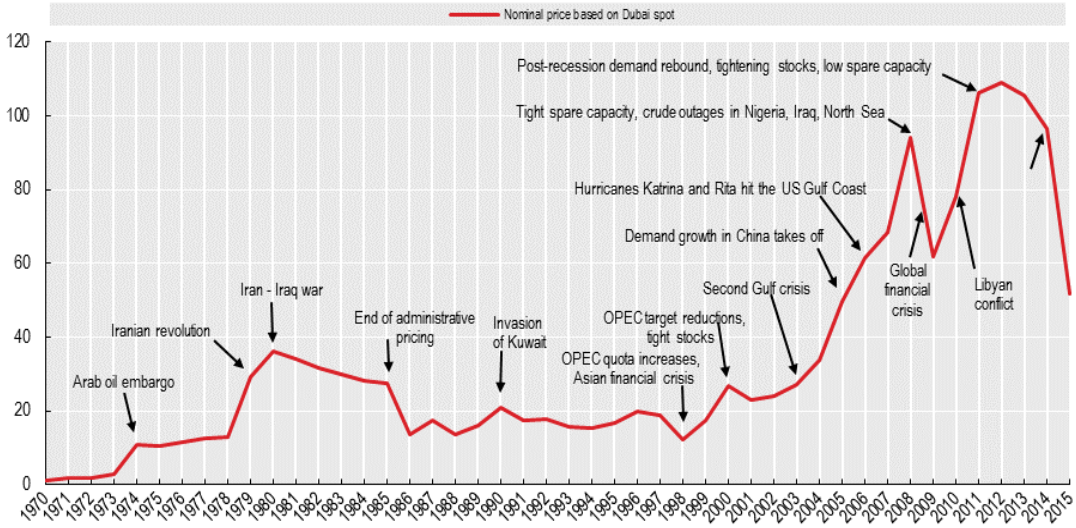


Figure 2: Crude Oil Spot Prices (US dollars per barrel)

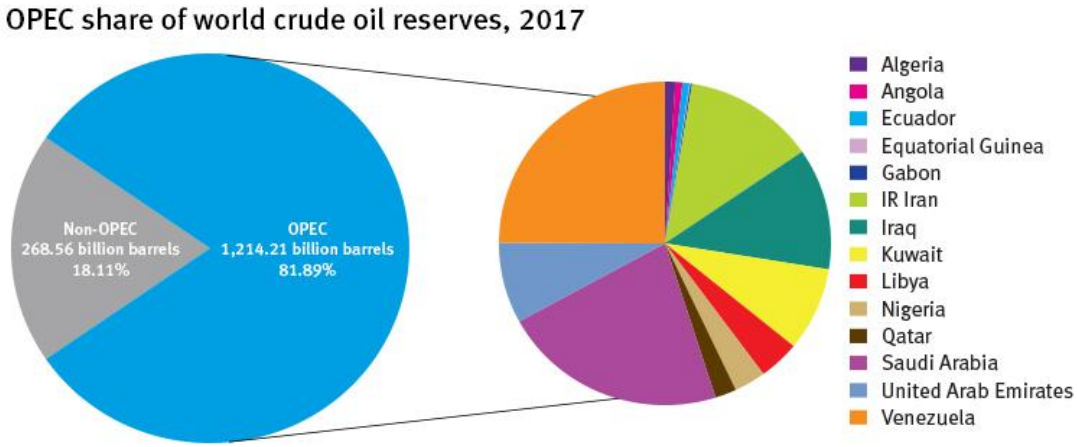
Source: OECD (2016), OECD Factbook 2015-2016: Economic, Environmental and Social Statistics, data accessed 18 May 2019

Firstly, the president of the United States is really effective on price changes by his political decisions. Recently, he declared that the United States would unilaterally exit the nuclear deal with Iran. The nuclear deal is an agreement, which restricts Iran to develop nuclear weapons and removes the sanctions on Iran, between Iran and a six-nation negotiating group representing the rest of the world. The president's decision would cause the sanctions to come back and suppress Iran's oil exports, which form 4 percent of total oil production, therefore, decrease the oil supply around the world. Although the European Union decides on keeping the agreement valid, the United States decision generates a political uncertainty which results in

higher prices. Despite Saudi Arabia has guaranteed that it will cover a possible supply loss left by Iran, the uncertainty is still live (CRS Reports, 2019).

Secondly, there are serious political and economic problems of Venezuela, which is another large oil supplier. As a result of these problems, the oil production in the country hurtles down. The oil disruption mainly stems from the problems with payments and equipment breaking down. Investments for drilling are declining due to negative and worsening economic conditions. Also, current oilfields owned by Petroleos de Venezuela slow down their production since workers leave their jobs because of low wages, security problems etc. (Wiseman and Beland, 2010, 153; Weisbrot and Sandavol, 2008, 2).

Thirdly, the demand side contributes to the recent price boom. The world economy is growing at around 4 percent, which boosts the demand, according to the IMF reports. It is clear that demand side cannot be ruled out when considering price movements.



OPEC proven crude oil reserves , at end 2017 *(billion barrels, OPEC share)*

Venezuela	302,81	24,9%	Kuwait	101,50	8,4%	Qatar	25,24	2,1%	Gabon	2,00	0,2%
Saudi Arabia	266,26	21,9%	UAE	97,80	8,1%	Algeria	12,20	1,0%	Equat. Guinea	1,10	0,1%
IR Iran	155,60	12,8%	Libya	48,36	4,0%	Angola	8,38	0,7%			
Iraq	147,22	12,1%	Nigeria	37,45	3,1%	Ecuador	8,27	0,7%			

Source: OPEC Annual Statistical Bulletin 2018.

Figure 3: OPEC share of world crude oil reserves

Source:OPEC Annual Statistical Bulletin 2018,data accessed 01.06.2019

2.6. The Organization of the Petroleum Exporting Countries (OPEC) and Oil Production

The Organization of the Petroleum Exporting Countries (OPEC) is an intergovernmental organization that gathers the following oil-exporting countries: Algeria, Angola, Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, United Arab Emirates, and Venezuela. The organization was founded in a meeting with the representatives of Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela in 1960. Indonesia and Qatar were formerly a member of OPEC but they decided to leave the organization afterward. According to its Statute, the OPEC's main objective is to coordinate and unify the petroleum policies of the member countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital for investors in the oil sector. OPEC observes the oil market and decides whether to decrease or increase oil supply based a voting mechanism among the members. Members are allowed to set their production levels independently but a decision mechanism in collaboration is usually a better way to set the production volume. (Dunsby et al., 2008, 220-225).

The organization itself is a very good example of monopoly in the oil market because it keeps hold of 43.53% of the total world crude oil production and 81.90% of the world proved crude oil reserves. (OPEC, 2018, 6) Also, OPEC has been one of the main actors in the major oil shocks. In the first half of the 1970s, for instance, the oil prices increased sharply as a result of the oil embargo of OPEC countries. OPEC countries decided to issue an embargo against the United States due to their support of Israel. Oil prices increased drastically as a result of this supply cut by OPEC. It was the first tour de force of OPEC in which they affected the prices strongly. Its powerful stance in the oil market places OPEC as an authority in politics as well.

Production of Crude Oil by Region

Thousands tons of oil equivalent (ktoe)

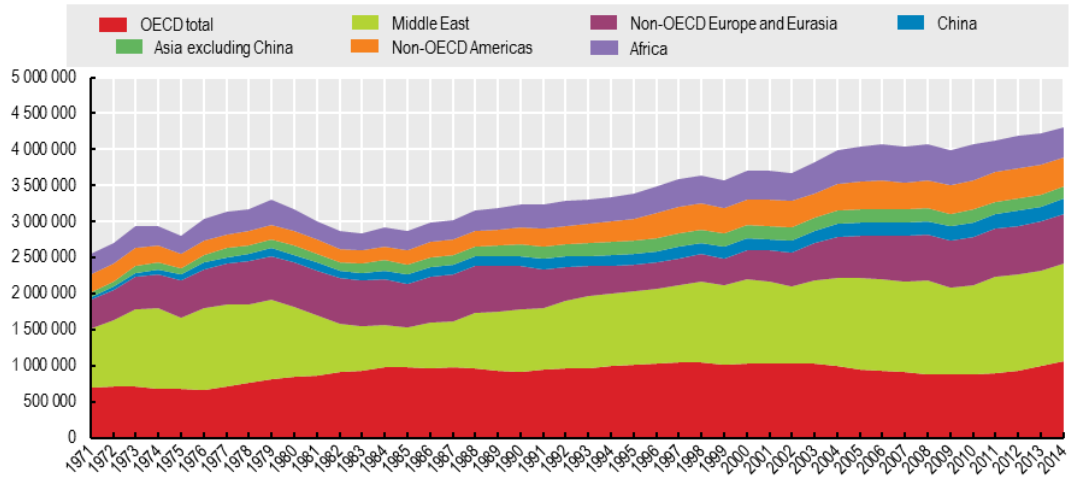


Figure 4: Production of Crude Oil by Region (Thousands tons of oil equivalent (ktoe)).

Source: OECD (2016), OECD Factbook 2011-2012: Economic, Environmental and Social Statistics, data accessed 01.06.2019

As mentioned before, OPEC is a crucial player in the oil market. It produced 43.53% of the total world oil production in 2017. Until the 1970s, OPEC increased its production share consistently. In the 1970s, it started to decrease oil supply due to the political conflict with the United States and the Iranian Revolution, therefore, its share in the total world production decreased. In the 1980s, oil prices began to fall from the peak levels of the 1970s as consumers started to reduce their oil use. Thus, OPEC decided to continue to lower the oil production to stabilize the prices and recover the profit loss of its member countries. Consequently, OPEC share in the total world oil production reached its historically lowest level (Griffin, 1994, 543).

Since 2014, an alternative way of drilling has starting becoming popular especially in the United States, called shale oil extraction. Basically, this method allows producers to drill petroleum locally without constructing huge refineries. According to the US Energy Information Administration, from 2011 to 2019, domestic oil production of the United States almost doubled, from around 5,500 barrels to 12,000 barrels per day. (EIA, 2019) As a result, OPEC's market power started to be threatened by the alternative drilling method in the United States. Since then, the new method put OPEC under pressure to either balance the market price by cutting production or keep its market share. (Forbes, 2019) On the other hand, the new method has a break-even price level to produce, namely, the oil price has to be above a certain

level in order to cover the expeses. Nowadays, the break-even price level for drilling through shale oil extraction is about $50 per barrel on average. The new method allows the oil market to be more stabilized. It means that oil prices would fluctuate between $50 and $80 per barrel. According to oil authorities, the monopoly power of OPEC is damaged by the invention of shale oil extraction. OPEC was founded in 1960 by Iraq, Kuwait, Saudi Arabia, and Venezuela. Now, it has fourteen members and; each member has a significant amount of oil reserves. OPEC's headquarter is located in Vienna, Austria.

OPEC works through its Conference, Board of Governors, Economic Commission Board and Secretariat. The Conference is the supreme authority of the organization and is composed of the representatives of all member countries. Each country has one vote right through its representatives. The representatives are usually the oil ministers of the members. The Conference gathers twice a year to make policies, ratify the budget and put the recommendations of the Board of Governors on the agenda. All decisions are taken by the full consensus of all members. The resolutions of the Conference are enacted 30 days after the conclusion of the meeting at which they are adopted if unanimity is present. (Stoehr, 1979, 96-97).

The Board of Governors, led by a chairman, provides the Conference with the annual budget, reports, and recommendations. It meets at least twice a year and adopts its decisions by a simple majority of attending members. The governors, nominated by member countries and approved by the Conference, have a two-year serving term. (Stoehr, 1979, 97).

The Secretariat, headed by a Secretary-General, performs the executive functions of OPEC. The Secretariat is responsible for the implemention of the Conference's resolutions and carrying out the decisions taken by the Board of Governors. Also, it conducts researches which are an important part of the decision-making process of OPEC. Furthermore, there are four divisions under the Secretariat: the Office of the Secretary-General, the Legal Office, the Research Division, and the Support Services Division. The Office of the Secretary-General mainly helps the Secretary-General to fulfill her duties. The Legal Office is responsible for providing legal advice to the Secretary-General. The Research Division is one of the most important divisions as it

conducts research on energy and economics and helps the organization to take effective decisions. (Stoehr, 1979,97)

2.7. Transmission Channels of Oil Price Shocks

There are, as is known, many factors that change and/or improve the economic system, including crude oil price. The price of oil can affect not merely fiscal policies, but also fiscal policy transmission ways including interest rates, exchange rate, domestic credit and share price for a country's domestic price. According to Gately et al. (2013, 845), for a study on determining the price of crude oil between 1997 and 2011, there are four important factors that led to an increase in crude oil prices. These factors are determined as the rapid growth in demand due to high global economic growth, reduced supply of non-oil producing and exporting countries (OPEC), cartel behavior of oil producers and speculative behavior of financial market participants. As a result of this research, it was stated that demand and supply are the two main transmission channels which affect the economy of the countries in determining the oil prices and thus cause fluctuations in oil prices.

2.7.1. Supply Side Channels

On the supply side, crude oil and by-products are fundamental input to the production process in general. Thus, any increase in oil prices leads to an increase in the production costs of firms. Increased costs mean lower yields for both the public and private sectors. In general, crude oil supply is divided into two categories: OPEC and non-OPEC suppliers. OPEC is an intergovernmental body consisting of 12 member states, which constitute a larger part of the world's oil production. OPEC was founded in 1970 to provide a stable oil policy for member countries, to provide coordinated actions for the price stability of the members and to provide an efficient, economic and orderly supply of oil to the oil importing countries. While non-OPEC members produce more of the world's oil, pricing power is mostly controlled by OPEC members because they control 71.3% of total oil reserves according to 2013 statistics. (British Petroleum, 2014). Non-OPEC members, especially Western states, have engaged in collaborative actions with OPEC member states to protect their economies internationally and their political interests, or to invest in technological

developments to produce alternatives to the oil market. According to a large number of literature reviews by Hou et al., oil prices are also affected by oil price shocks where it is allowed to simultaneously affect all other macroeconomic variables. As it is known, since the US dollar is the only pricing and reconciliation currency in oil transactions, the fluctuating value of the dollar affected by the US monetary policy plays an important role in the rise of increases and the sharp decline in world oil prices even though pricing power is mostly in the hands of OPEC countries. For this reason, it would be accurate to define a function of concurrency between oil prices and the rate of funding in the United States. In this context, the transmission of oil price shocks differs depending on both the country-specific and the world economic conditions. For example, the main reson why two states are affected by oil price shocks and the transmission of it differently can be explained by comparing Canada and Turkey considering especially currency depreciation of the Turkish lira to the US dollar and the lower economic conditions of Turkey in contrast with Canada. Further, it is obvious that supply of labor and technological innovations will differ between Canada and Turkey due to reasons mentioned above. In short, supply side of oil price shocks transmission is dependent on countries' fragility to the USD dollar weighted rate of return.

2.7.2. Demand Side Channels

On the demand side, as Hamilton noted, shifts in oil prices due to shocks mainly affect consumption and investment (Hamilton, 1996, 218). An increase in oil prices raises the overall price level. Higher prices result in lower purchasing power and lower real disposable income levels which results in a reduction in total demand. (Riman et al., 2013, 517). As countries develop, the demand for oil is increasing in order to maintain industrialization and higher living standards. (Dunlap et al., 2009, 1) Current evidence demonstrates that oil consumption is increasing globally. In 1990, the world's daily consumption of oil was 66.653 thousands barrels whereas, the figure increased by 31.102% in 2010 snd reached 87.439 thousand barrels. In 2014, oil consumption in the world increased by 1.4 million barrels (or 1.4%) per day compared to the increase in global oil production, which increased by 0.55 million barrels per day (or 0.65%) (British Petroleum, 2014). Consumer preference shock may occur when the change in oil prices is reflected in the supply of agricultural products. For example, the dairy and meat-derived food sectors are inevitably

affected from corn which is used as raw material and / or from corn-fed animals. A shock in the oil price is reflected on the consumer because cost increase is reflected on the producer and consumers would need to change their preferences. As a result, oil price shocks are transmitted to many sectors due to the shocks on the demand side too.

2.7.3. Economic Policy Responses

Monetary policies are based on the objective of stabilizing prices; therefore any economic shock with a negative effect on prices is considered a threat to the domestic economy which must be controlled (Razmi et al., 2016, 582). Many studies have showed that there is an inverse relationship between economic activities and oil price shocks (Abiona, 2015, 600). Bernanke et al. (1997, 105) demonstrated that major real impacts of oil price shocks do not occur directly by the shocks but by the ensuing tightening of monetary policy.

Once the petrol price shocks start affecting the economy, all countries have their own response system based on their nature of economies. Price oil shocks cause negative impacts on both supply and demand of products, industries and markets are also negatively affected due to several reasons. One reason is that uncertainity in oil prices lead to companies postponing their investments. As the uncertainty in oil prices increases, investment deferral decisions increase and incentives to invest decrease. In an environment with high energy prices, the uncertainty about how the firms will survive decreases investor confidences and interest rates start increasing. As a result, the decline in investment expenditures weakens the economy (Brown et al., 8). Another response to oil price shocks can be considered as sectoral imbalances by changing the balance relationship between sectors. The increase in oil prices affect contraction in energy-intensive sectors unlike results in expansion in energy-efficient sectors (Brown et al., 8). Rising energy prices, forces companies with a production technology embedded in the capital stock to change their capital stock. As a result of this, the adjustment period takes longer when energy prices are increasing and the economic organization is disrupted (Öksüzler et al., 2011, 18).

3. THE EFFECTS OF OIL PRICE SHOCKS ON TURKEY

Since the late 1970s, fluctuations due to increase in crude oil and petroleum products prices have been the subject of research for explaining that chronic and high inflation in Turkey for many years. In this section, first impact of oil prices fluctuations' on Turkish economy will be examined period by period, second it will be analyzed that both direct and indirect effects of it on Turkish economic growth rate, and then finally it will be studied about scenarios of future effect of fluctuations in oil prices on the Turkish economy.

3.1. The Impact of Fluctuations in Oil Prices on the Turkish Economy between 1973-2017

Due to the fact that crude oil is the most basic energy source, both positive and negative changes in oil prices have important effects on two main areas: high oil prices on production increase inflation rates and fiscal policies followed to make the economy of Turkey stable as an oil importer state. Below these fluctuation effects will be examined in specific periods.

3.1.1. 1973-1995 Period

As in many developing countries crude oil is one of the most primary energy source that is strategically positioned for Turkey. Turkey welcomed the 1970s with a tax reform which increased the public revenue. However, the oil shock and the Cyprus Peace Operation cut the effectiveness of fiscal policies in these years (Öztürk et al., 2017, 6). The operation actions have led to further detoriation of the economic situation in Turkey. Weapons and military support from Turkey to Cyprus led to extra expenses during the operation. Excessive increase in interest rates as oil price rose, made Turkey become unable to pay increasing cost of its debts including Cyprus military operation cost as well. Since Turkey was an oil importer, the oil shock increased the trade deficit severely. Trade deficit was almost tripled in 1974, from $750 million to $2.25 billion (TURKSTAT, 2018). In contrast to the oil saving tendency in the world, Turkey subsidized the oil consumption and a need for foreign currency emerged. The country had to borrow a large amount of debt from abroad

with high interest rates in order to stabilize the balance of payments. Positive growth rates have been seen in these years based on consumption. Yet, the deficit in the balance of payments deepened further and political and economic stability were damaged. While the propensity to consume was increasing, production remained limited. As a result, inflation rate was close to 20 percent, far above the world average.

Turkey suffered from with the devastating effects of inflation in 1970s. Between 1970 and 1980, the rise of price of the barrel of oil was $ 2.74 to $ 11.65 and the world of economies due to the distress experienced in the export sector depressed. (Aydoğan, 2019, 91) Use of oil is inevitable to Turkey's industrialization, but the increase in oil prices largely affected Turkey as an oil importer country. The importing rates can be seen in the Figure 5.

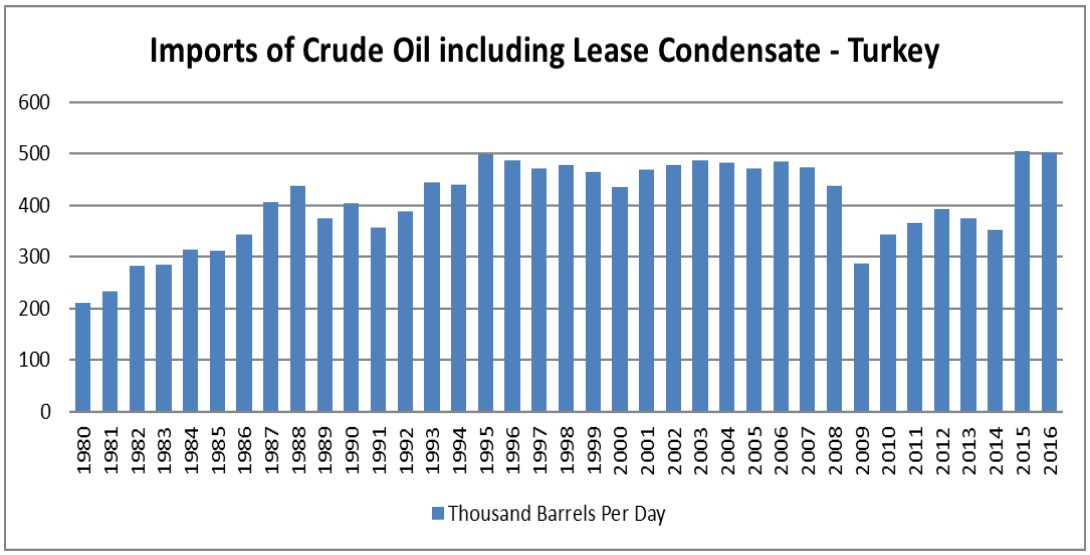


Figure 5: Import of Crude Oil Including Lease Condensate – Turkey

Source: Data adapted from the Titi Tudorencea Bulletin, (1991-2019), Turkey: Production of Crude Oil Including Lease Condensate, data accessed 21 February 2019.

In the pre-crisis period, the Turkish government was fueling the consumption for saving the day. Instead of investing in production, the money borrowed was distributed to people and even low-income families started demanding luxury goods. Between 1970 and 1977, the external debt stock almost quadrupled. Turkish economy was already giving bad signals and the oil crisis deepened the economic problems. In 1980, the inflation rate skyrocketed to 110 percent. The Turkish economy contracted in two successive years, in 1979 and 1980. Unemployment rate

jumped to around 20 percent many of the basic consumption goods were rationed and the black market developed. It was the famous period to which some Turkish politicians referred as "Bread, olive, sugar was rationed in this country." In 1980, there was a military coup and the army took over the government. Decisions of 24 January 1980 were put into the effect under the leadership of Turgut Özal on the purpose of easing the negative effects on the Turkish economy. Turkish Lira was devalued by 32.7 percent and the economy was liberalized.

In 1978, the inflation rate reached 52.6%. The energy and foreign exchange bottlenecks were observed particularly in the industrial sector, which led to the use of incomplete capacity during the 1970-80 period. (Aydoğan, 2004, 93) Also, the contraction in the industrial sector reflected to GNP and it led to a decline in the welfare of the people. The services sector was also affected by these bottlenecks and decreased by 0.22% in 1980. Merely increasing economic crisis and energy bottlenecks in the industry sector were recorded but also unemployment rates increased. (Çeçen et al., 1994, 44). After 1980, the political instability caused the economy to become depressed and the IMF started to sign Stand-by agreements with Turkey in order to save the economy from the difficult situation. Short-run and long-run goals with this program in the institutional structure of the economy and traditional changes in industrialization strategy, weighted privatization will be given (Çeçen et al., 1994, 45). Accordingly, as a result of the fiscal policies followed, inflation rate decreased. The most important factor in the reduction of inflation was that the fluctuation in oil prices reduces the purchasing power of the consumers. Even if these policies were followed to fix the economic problems based on oil price shocks effects, economic instability was experienced again which increased inflation rate in the first half of the 1990s.

3.1.2.1995-2001 Period

The world began the 1990s with another oil price shock event which was the Gulf War between Iraq and Kuwait. The 1990 Gulf crisis caused a sharp increase in oil prices; an increase of 120% in oil prices. This sharp leap in oil prices affected the Western economies, but also affected oil-addicted, developing or less developed countries. Turkey was one of the countries that effected by oil price shock in its economy as a developing country because Turkey is an oil importer country. There

was an economic instability in the first half of the 1990s period, Turkey experienced different growth rates which created uncertainty in the economy. This uncertainty has made the economy risky and as a result, there were foreign capital outflows from the country. The highest rate of inflation was experienced in 1994 (Yentürk, 1999, 106).

3.1.3. 2001-2008 Period

In Turkey's early 2000s period, consecutive crises were experienced at the beginning of November 2000 and February 2001. It caused a substantial effect on Turkey's economy. First of all, in early November, new regulations for the banking sector began to gain momentum and the banks entered into fast and sudden decisions to close their open positions and a liquidity crisis emerged in the last ten days of November (Turan, 2011, 70). In order to maintain the program, precautions were taken to prevent deepening of the crisis. However, Turkey faced a new crisis. After the 2001 crisis, Transition to Strong Economy Program (GEGP) was applied. GEGP's tight monetary policy led to instant decrease in inflation. In the beginning of 2002, ''inflation targeting'' was put in process. Implicit inflation targeting was carried out between 2002 and 2005, and since 2006 inflation targeting has been implemented. Besides, Turkey's economic crisis has deepened with the increasing price of oil as well. Oil is the most important input of the manufacturing industry, which is the core economic input in national economies. However, the fact that petroleum energy is not distributed equally to all geographies brings out a high cost problem for some countries in supplying such resources. Oil prices have risen up to three times the normal price from time to time with the wars in the Middle East. The sharp shifts in oil prices had an adverse effect on the economies of oil-dependent countries such as Turkey. Manufacturing industry is one of the leading sectors that provide real growth in a country and these sectors provide the most employment. So oil price changes affect the manufacturing industry and hence the employment of the manufacturing industry.

Oil prices rose rapidly during the period of 2003-2007, when global economic growth was at the highest level and the demand for oil was therefore high. During the same period, due to increased demand, there was a shortage of personnel, equipment and technical information, investment rates diminished, the costs and accordingly the

oil prices rose rapidly. Analyzing the periods in which oil prices rose rapidly in the past, it is seen that the price increase creates inflation through cost increases and decreases global consumption demand by reducing disposable income levels. Global economic growth is slows down as central banks raise interest rates to keep them cautious against inflation. (Yetim, 2019, 10) However, the main reason for the increase in oil prices in the current situation is different from the past because growing global economy is demanding more and more energy. As the effects of oil prices on the growth of the global economy can be observed in both domestic and foreign economic activities of countries it can also be observed that Turkey was negatively impacted from oil prices shocks on top of its own economic crisis as well. On the other hand, despite the crisis, Turkey aimed to spend the period 2000-2008 with less damage by following different fiscal policies.

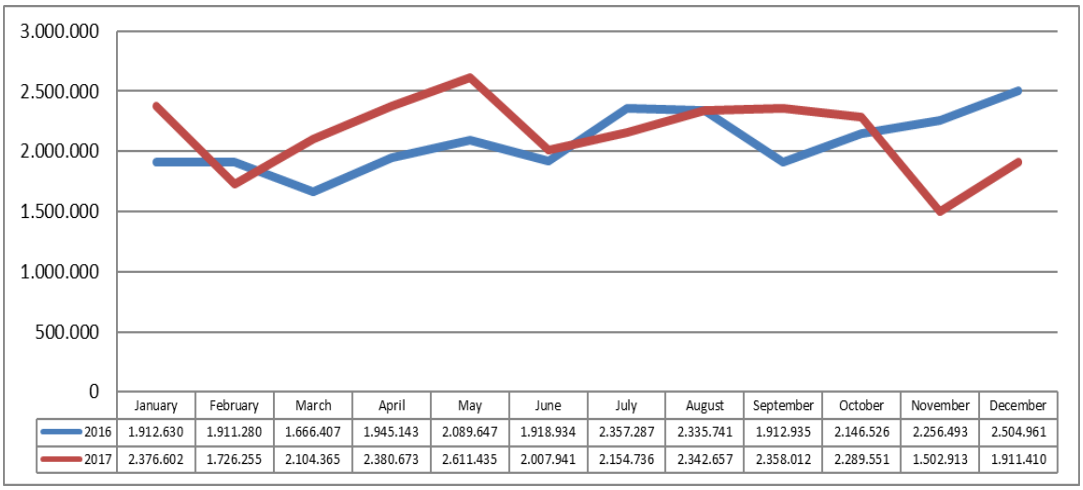
Turkey, as a developing country, achieved high growth rates between 2002 and 2008. The country was economically strong till 2008. According to the TURKSTAT data, the country consistently imported around 23 million tons of crude oil between these years. Turkey needs to import oil in order to achieve high growth because its growth mainly comes from construction and industry sectors. Considering one of the structural problems of Turkey, current account deficit, oil price increases were the main driver of the problem. Turkey had an increasing trend in current account deficit in these years due to the surge. One can easily claim that Turkey could grow in a more sustainable way if oil prices did not rise in such a manner because current account deficit was one of the major obstacles for the Turkish economy. It clearly deteriorates the sustainability.

3.1.4. 2008-2018 Period

To analyze the last period, the effects of "2008 Global Crisis" all over the World need to be analyzed. As Ünal and Kaya have stated (Ünal and Kaya 2009) the crisis started in the USA in 2007 and the fourth largest investment bank of the US, Lehman Brothers, declared bankruptcy with 600 billion dollars in debt and it is defined as the biggest crisis in the world after the Great Depression of 1929 (Göçer et al., 2012, 192).

After 2001, the liquidity facilities offering high interest rates experienced in world financial markets have also benefited the economy of Turkey**.** This abundance of

liquidity ended with the global crisis. Turkey also had been influenced by the global crisis just like every other country in the world. The outsourcing needs of Turkey have been affected negatively because of the significant decrease of the funds from the international markets after the crisis. In this turn also Turkey had problems about external borrowing costs and opportunities. The fact that Turkish banks had a powerful structure with capital adequacy ratios during the crisis period and that they did not invest in risky instruments increased the resilience of the Turkish economy against the crisis. It is significant to highlight that the most of the economic activities take place directly or indirectly depending on energy which is the magnitude of the use of oil in energy source brings the oil market to the forefront (Solak, 2012, 117). By way of contrast the positive financial standing of Turkey towards the global crisis, crude oil prices, which started below the 30-dollar level in the 2000s, then climbed rapidly and steadily to $ 100 in 2008, when the global crisis broke out. The prices, which entered into a sharp downward trend with the crisis, started to recover again in 2010 as a result of the partial recovery in the global economy. In 2011, the MENA region (Middle East and North Africa) triggered a serious attack with the triggering of events, the post-crisis levels reached record levels. After the high levels recorded in 2011 and 2012, the volatility in the markets continued. Oil prices continued to fall in 2015 Turkey's oil and natural gas as well as importing countries have reduced the cost of oil and natural gas imports. Current account deficit in 2015 with the decline in oil prices parallel to the decline in trade deficit, decreased by 26% compared to the previous year and was announced as $ 32.19 billion (Türkiye Petrolleri, 2016, 24). The figure below demonstrates the distribution of crude oil imports of Turkey.



	January	February	March	April	May	June	July	August	September	October	November	December
2016	1.912.630	1.911.280	1.666.407	1.945.143	2.089.647	1.918.934	2.357.287	2.335.741	1.912.935	2.146.526	2.256.493	2.504.961
2017	2.376.602	1.726.255	2.104.365	2.380.673	2.611.435	2.007.941	2.154.736	2.342.657	2.358.012	2.289.551	1.502.913	1.911.410

Figure 6: Distribution of Crude Oil Imports by Month in 2016 and 2017 (tonnes)

Source: T. C. Energy Market Regulatory Institution, data accessed 12 April 2019

As known from the industries, petrol, oil and gas prices directly affect the fixed costs of production. For this reason, oil costs' changes can cause decrease in the production and, increase the prices of goods and services. This negative economic structures influences the market and increase inflation and unemployment. The firms especially producers have to go downsizing. In particular, with the financial crisis experienced intensively from the last six months of 2008 to the end of the year 2009, production and national income declined, while unemployment rate increased to historical levels (Kutlu et al., 2007, 130). In just one year unemployment ranks of Turkey changed to 3 million people from 2.2 million. About 800.000 employees lost their jobs because of the financial problems of the market. In 6 years –until 2015- the number of unemployed increased by 200.000 people and it became 3,2 million totally. But here it should be said that the number of unemployed decreased to 2,8 million in the spring 2015 because of seasonal employment in some sectors such as agriculture or construction. But it was not a continuous employment (Sungur, 2000, 251).

When completing the analysis of the period taken into consideration Turkey's dependence on oil prices, it is recommended that the necessary measures are taken to produce existing and developable energy resources both in the state institutions and in the private sector energy reports. Lastly, referring to reinforcing the potential to

become an energy center of Turkey with multilateral projects some data will be shared. These are listed and shared as a figures as well (Merdan, 206, 72):

Baku-Tbilisi-Ceyhan Crude Oil Pipeline (BTC)

• The Iraq-Turkey Crude Oil Pipeline

• Baku-Tbilisi-Erzurum Natural Gas Pipeline (BTE)

• Samsun-Ceyhan Crude Oil Pipeline

• Trans-Anatolian Natural Gas Pipeline (TANAP)

• Turkey-Greece Interconnector (ITGI)

• Iraq-Turkey Natural Gas Pipeline projects are available

Figure 7: Extending or planned international oil and gas pipeline projects in Turkey

Source: Türkiye Petrolleri, Ham Petrol ve Doğal Gaz Sektör Raporu, 2016-data accessed 3 April 2019

When it comes to the effects of rising oil prices on Turkey, current account deficit problem is the front-runner. Since Turkey is an absolute oil importer, its current account deficit deepens, above 5 percent as a percentage of GDP, as prices rise. On the other hand, Turkish Lira has been depreciating against the US dollar constantly

for five years. As the Turkish Lira depreciates and oil prices rise in terms of US dollars, the increase in the inflation rate is drastic. Last month, in June 2018, consumer prices have increased more than 15 percent compared to the same month in 2017. One of the main drivers of the high inflation is increasing oil prices. For example, fuel oil prices broke records over 6 Turkish Liras and the government had to decrease the private consumption tax on fuel oil to settle down the consumer price increase.

3.2. Direct and Indirect Effects of Oil Price Shocks on Turkey

Abeysinghe (2001, 147-153) divided the effect of oil price shocks into two sub-effects. The direct effect received from an increase of oil price and the indirect effect which works through an economy's trading partners. In this section, direct and indirect effects of oil price shocks analyzed in detail.

3.2.1. Direct Effects of Oil Price Shocks

The rise in oil prices related to shocks has two sided effects on open economies. Indirect effects demonstrate effects by countries' economic activities with their trade partners. For instance, it can be experienced when Turkey attempts to import an oil from net oil exporter countries such as Iran, Russia, Iraq, Kuwait and etc. higher oil prices effects Turkish GDP growth negatively while these net oil importer countries have benefits with higher export revenues for their own GDPs. Therefore, it can be said that the prices influence Turkish economy and this influence can be understood by checking direct and indirect impacts on the economy. The size of the effects of oil prices on Turkish economy also helps us to understand their impact on the economic development if it is positive, negative, huge or low.

3.2.1.1. The world's production capacity of oil

On the basis of fundamental economics, an increasing supply of oil causes the price to fall. Oil, on the other hand, is a limited source to a certain extent as the supply is a non-renewable resource. Since the early 1990s, there has been no significant new oil fields, and no progress can be reported on transport and refining. In short, in this period, small improvements in production capacity, which did not increase at the same rate as world consumption, were recorded (Yan, 2012, 42). However, in the last

years, new extraction methodologies were found for shale oil that has changed the oil market to a great extent. It has become easier to obtain oil with the use of crushing and horizontal drilling, but until recently there have been no economically feasible reserves that have led to a significant increase in oil supply (Aguilera et al., 2013, 155). It is known that a certain amount of oil determined by OPEC countries affects the oil supply and thus the price in the world. OPEC joint countries account for forty three percent of all supply in the world (OPEC Annual Report, 2017, 32) and produce oil according to certain policies. Therefore, their decisions inevitably move prices in certain directions. Also increasing risk and uncertainty, effects oil prices. The risks in the market are the basic influencers of future plans of OPEC.

3.2.1.2. The global economic growth

Global crude oil demand has a direct impact on its price, which can be easily seen by studying historical events. As Yan has stated, growth leads to an increase in the demand for crude oil, which can perform above the supply and lead to an increase in oil prices (Yan, 2012, 43). For instance, there has been a rapid development in the early years of the 21st century, particularly in the new industrialized countries. (Yan, 2012, 42). Another example can be given as the financial crisis that took place during in the second half of 2008. When the economic growth of the world stagnated and oil demand remained constant, it caused prices to fall. (IMF, 2015, 3). Therefore, it is stated that there is an obvious relation between demand and fluctuations in international oil prices.

3.2.1.3. Change of crude oil inventories

When the price of oil falls, producers are encouraged to increase their inventory to raise prices. Then, when the price rises, they can increase their production again. However, as producers enter the market, prices may be repressed. As the theory of economist Harold Hotelling has stated that businessmen, producers and manufacturers decided to explain by using more complex theories (Chilton, 1984, 629). The Hotelling's rule states that in a competitive market with no extraction costs the price of an exhaustible resource will grow at the rate of interest.

3.2.2. Indirect Effects of Oil Price Shocks

Oil price shocks has a substantial effect in economy indirectly, too. The indirect effects of oil price shocks could be categorized into three sub-categories.

3.2.2.1. Practices in the future market

The speculative estimates about the future cause price shifting. Researchers such as (Boheman and Maxén (2015, 11) say that the costs of oil in the international market futures works as a benchmark price when evaluating the current price and for this reason the spot oil price is highly affected by the opportunistic factors on the future market. Agents can make their production and consumption policies to the wrong assumptions that will have inevitably impact on the oil spot price in the short term. (Lombardi et al., 2011, 10)

3.2.2.2. Dollar Exchange Rate Fluctuations

Appreciation/Depreciation of the US dollar directly effects the prices of oil. An increase or decrease on dollar value, changes the prices of oil in the international market. This means that the most international oil trading transactions are billed, delivered and realized in USD in 1974. Therefore, whenever the fluctuation occurs in the value of the dollar, exchange rate has a direct influence oil policies in not merely exporting but also consuming countries as well as international oil prices (Yan, 2012, 43). When the US dollar is depreciated, the real profits of oil exporting countries will be reduced. To overcome this situation, OPEC member states try to keep the oil price rise to a minimum. Based on the Cheng's examination, an increase of 1% in the dollar rate causes decrease in the price of oil to by 3.06% in the long term (Cheng, 2005, 20).

3.2.2.3. Geopolitical turbulence

Geopolitical factors are a risk factor for the rise of international crude oil prices. The world's oil reserves are in the most politically troubled areas. Likewise, most of the world's leading oil suppliers come from problematic areas such as Iran, Iraq, Nigeria, Venezuela and Russia. Political and social conflicts can affect the oil price both directly and indirectly. As a well-known example, as a result of the US invasion of Iraq, the production of Iraq, which is the oil supplier, has decreased. In addition, sabotage attempts in Nigerian pipelines are considered as a direct effect on oil prices.

The ongoing political conflicts between Palestine and Israel, which have been in the Middle East for many years, and the Iran's uneasiness nuclear program are the various instances which have an indirect impact on changes in oil prices (Keppler, 2007, 26).

3.2.3. Scenarios of Future Effect of Fluctuations in Oil Prices

The impact of oil prices in the financial sector and global economic relations have reached non-negligible levels. Price fluctuations (development and / or exchange) are considered to be one of the key variables in international economy and trade. When analyzing the Turkish economy based on the world economy, one of the factors that closely affect the developments for 2017 and later periods is the oil prices. As a result of technological developments and investments in these fields, the USA has expanded its new oil fields and expanded its shale gas facilities. In addition, because of the increasing use of sustainable energy resources, the determinants of the Gulf region and the region's issues on oil prices have decreased relatively. When these conditions are considered, a 14.1 percent reduction in oil prices is expected in 2019 (EBSO, 2018, 132). This expected oil price reduction will be a beneficial factor for the economies for oil importer countries. Berument (2010, 152) indicates that a decrease in oil prices will be positively affected by the current account balance and inflation. In this context, whenever oil prices decrease Turkey is positively influenced as an oil importer country. In line with this expectation, the possible decrease in oil prices will have positive results for the allocation of inter-sectoral resources. It is foreseen that the demand side will be positively affected by this price change and the domestic income will be balanced.

On the other hand, the fluctuations in oil prices do not merely take place due to economic and technological reasons but also based on the political relations/crisis between countries. For instance, the world's most important oil shock crisis (OPEC crisis) was a political response. When the present political atmosphere is examined, the terror and war crises of the Middle East, which is the basic source of oil, play an important role in the foreign policy of the countries. If Turkey changes its foreign policy or attitude towards the political crisis to neighboring countries, it may be exposed to various sanctions. For example, there is a potential threat for Turkey as a NATO member country, within the scope of the agreement on Russian S-400 missile

systems to be exposed to sanctions by the United States. Vice President Mike Pence repeated warnings to Turkey not to proceed with the purchase of Russia's S-400 missile defense system by saying that ''We will not stand idly by while NATO allies purchase weapons from our adversaries. We cannot ensure the defense of the West if our allies grow dependent on the East" at the Munich Security Conference. (Copp, 2019). Furthermore, many times, US President Trump has said economic sanctions could apply to Turkey related to moves of Turkey in its foreign policy. Identically, the diversification of the oil market, either directly or indirectly from the US studies in the oil field, may not only lead to positive results, but at the same time, any political and diplomatic crisis that will be reflected in oil prices will not reduce the possibility of shock in oil prices.

As a result, Turkey experienced both positive and negative oil price shifting effects on its economy due to the variability of value in the oil market. All things considered, to reduce Turkish economy's dependence on oil prices, making the technological and technical investments related to the energy sector is recommended.

4. AN APPLICATION ON THE IMPACT OF OIL PRICES ON THE ECONOMIC GROWTH OF TURKEY (2003-2018 PERIOD)

4.1. Emprical Literature on Oil Shocks

When the previous literatüre studies are examined, it is seen that there is a close relationship between oil prices and economic growth.

Hamilton (1983), in his VAR analysis for 1948-1980 period, found a negative correlation between oil prices and real GDP in the USA.

Burbridge and Harrison (1984), found that the increase in oil prices has a statistically significant effect on industrial production in their study with the VAR model for the United States, Japan, Germany, England and Canada.

Rautava (2004), analyzed the period between 1995:Q1-2002:Q4 using the VAR method for the Russian economy, in his study it is examined the effect of oil prices and real exhange rate on real GDP; he noted that a 10% increase in international oil prices led to 2.2 % increase in Russia's economic growth in the long-run, and a 10% increase in Ruble caused a 2.7%decrease in Russia's economic growth.

Ito (2010) examined the effect of volatility in oil prices on Russia's economic activities for the period 1994: Q1-2009: Q3 with the VAR model and stated that the 1% decrease in oil prices increased Russia's exchange rate by 0.17% and growth rate by 0.46%

Jbir and Ghorbel (2009) investigated the effect of oil price shocks on economic activities such as industrial production index, government expenditures, real effective exchange rate for the period 1993:Q1-2007Q3 using VAR method for the Tunisian economy, he could not find any evidence of an asymmetric relationship between economic activities and oil prices in both linear and non-linear models.

Park and Ratti (2008) examined the oil price shocks in the USA and European countries during January 1986-December 2005 period using the VAR model. The variables included in the model are stock prices, short-term interest rates, consumer

prices and industrial production. According to the results of the research, oil shocks have a significant effect on stock returns in the same month or the following month.

Nandha and Faff (2008), examined the relationship between the oil price shocks and stock returns between the April 1983 and September 2005. According to the results of the research, the relationship between stocks and oil prices was found to be negative in all sectors except mining, oil and gas sectors.

Korkmaz and Çevik (2008), analysed the period between 1992 January to 2008 March for the effects of macroeconomic variables in Turkey and they did not determine statistically significant correlation between the return on the ISE with oil prices.

Osigwe and Arawomo (2015) looked at the Granger casuality relationship between oil prices, economic growth and energy consumption for Nigeria during the period 1970-2012. They divided energy into two sub-categories (oil and electricity) and evaluated them equally. The results of the analysis for total energy consumption showed that there is two-way causality relationship between electricity consumption and price.

Soytaş et al. (2001) examined the casual relationship between energy consumption and GDP using data from 1960 to 1995 and applied the Johansen-Juselius Cointegration Methodology and Vector Error Correction Modeling test to analyze this relationship. They found unidirectional causality from energy consumption to GDP.

Fidan (2006) examined the relationship between energy consumption and economic growth by applying the Granger causality test. In addition to the relationship between primary energy consumption and GDP, the relationship between primary energy sub-groups oil, coal, natural gas and secondary energy electricity and GDP was also examined. As a result, there is a two-way relationship between economic growth and electricity consumption, and a one-way causality relationship from economic growth to oil consumption.

Mucuk and Uysal (2009) analyzed the relationship between energy consumption and economic growth with the data of 1960-2006 period with unit root, cointegration and Granger causality tests. They found a one-way causality relationship from energy consumption to economic growth.

Aydın (2010), firstly using the quarterly data of 1996:01-2004:04 period, made a study to find the realtionship between total primary energy consumption and GDP. Then using the annual data of the period 1980-2004, he formulated disaggregated equations for the resources constituting primary energy consumption. He has come to the conclusion that energy consumption is the reason for economic growth.

Aytaç (2010) examined the causality relationship between energy and economic growth for the period covering 1975-2006. Granger causality and multivariate vector autoregression (VAR) models are applied. He concluded that there is one-way causality from energy consumption to labor and economic growth to capital.

Özata (2010) examined the causality relationship between energy consumption and GNP in the period 1970-2008. As a result, he found that the real GNP and energy consumption are cointegrated and a one-way Granger causality relationship from real GNP to energy consumption.

Akan et al. (2010) analyzed the relationship between economic growth and energy consumption with the help of ADF unit root analysis, cointegration approach, Granger causality test and Error Correction Model using 1970-2007 data. They concluded that there is a two-way causality relationship between economic growth and energy consumption.

Doğan (2011) tried to find a relationship between energy consumption and economic growth during 1980-2008. As a result of the causality tests, no relation was from GNP to energy consumption, but it was found that a one-way causality relationship from energy consumption to GNP was at 10% significance level.

4.1.1. Determinants of Oil Shocks

The oil price shocks till now are associated with supply shocks arising from geopolitical conflicts, although their frequency and impact decreased after the Gulf War. Demand shocks had become increasingly significant drivers in the late 1990s and are principally associated with major global economic expansions and contractions. Furthermore, there is a strong existence of precautionary demand shocks in several stories that reflect shifts in the demand for oil associated with the forward-looking behavior of the market participants. Nevertheless, episodes that are

associated with market imbalances, i.e. positive shifts in the demand for oil confronted by limited oil supply response and with strong supply growth confronted by stagnant demand, produced the most substantial oil price shocks by historical standards. It follows that none of the market fundamentals can be an important determinant by their own, rather it is the catalytic interaction of both supply and demand that has historically driven the oil price (Economou, 2016, 3).

4.1.2. Supply Shocks

It is widely hypothesized that exogenous supply disruptions are really deterministic on oil prices especially before 2000s. Hamilton (2003, 387) suggests a measure of exogenous oil supply shocks by presenting a quantitative version of the dummy variable approach introduced by Dotsey et al., (1992, 18) He argues that the oil price shocks were mainly caused by substantial disruptions in crude oil production that were brought about largely by exogenous geopolitical events, providing the 1973 Arab Embargo, the 1979 Iranian Revolution, the 1980 Iran-Iraq War, and the 1990 Gulf War examples. However, Hamilton is criticized by Kilian who describes three drawbacks of Hamilton's approach: (1) the method assumes that the level of oil production remains the same in the absence of exogenous event; (2) it does not allow for the response of oil production to the exogenous geopolitical event to be immediate or delayed; (3) it does not allow the response to be long-lasting, time- and sign-varying (Economou, 2016). To solve these issues, Kilian proposes an alternative measure of exogenous oil shocks. His conclusion presents three important points: (1) the exogenous oil supply disruptions can account for only a comparatively small part of oil price movements; (2) 1980-1981 price increase was the crisis that can be attributed to an exogenous supply disruption; (3) the oil price increases in 1973, 1979, and 2004/2005 were driven by strong global demand for oil consumption (Kilian, 2008, 234)

4.1.3. Demand Shocks

After 2000, it is widely documented in the literature that demand shocks play important roles in oil price changes. However, since it is difficult to quantify the demand for oil, researchers are struggling with how to reflect the effect of demand on oil prices. Kilian constructs an index of global real economic activity which is based on representative single voyage freight rates collected by Drewry Shipping

Consultants Ltd. for various bulk dry cargoes (Kilian, 2008, 229; Kilian, 2009, 1056; Economou, 2016, 5). He categorizes the key determinants of the oil price into three: (1) shocks to the current availability of oil; (2) shocks to the current demand for crude oil; (3) shocks driven by shifts in the precautionary demand for oil. His results demonstrate that oil prices are increased significantly by demand-driven shocks and support that the previous oil shocks were as much demand-driven as the post-2000 oil shocks. Moreover, Kilian and Murphy (2014, 29) show that the oil price rise in recent years has been associated to the market mechanism as well as the effect of flow demand shocks.

4.1.4. Other Demand Shocks

Another driver of an oil price shock is precautionary demand in the uncertain environment. Barsky and Kilian (2004, 12) insist on the importance of willingness to stockpile in war environments. The precautionary demand for oil creates an artificial demand and pushes up the price of oil. They stress the effect of this while explaining especially the shocks centered in the Middle East. Furthermore, Kilian and Murphy (2014, 18) proposes a new term "physical speculative demand" which is defined as the demand for oil to store for future use, based on the forward-looking behavior. This type of demand shock was especially effective on all the oil shocks except for the ones which occurred after 2003 onwards.

4.2. Data and Methodology

4.2.1. Econometric Model

In this study, the following model is used to examine the relationship between oil prices, inflation and economic growth in Turkey for the period 2003-2018.

$$\mathrm{LGDP}_t = \alpha_0 + \alpha_1 \mathrm{LOIL}_t + \alpha_2 \mathrm{LCPI}_t + \mathrm{u}_t \qquad (1)$$

GDP= Gross Domestic Product,

OIL= Oil Prices and

CPI= Consumer Price Index

Turkey's oil prices, inflation and economic growth are analyzed by using Vector Autoregressive Model (VAR)

$$\mathrm{GDP}_t = \alpha + \sum_{j=1}^{m} \beta_j GDP_{t-j} + \sum_{j=1}^{m} \delta_j OIL_{t-j} + \sum_{j=1}^{m} \theta_j CPI_{t-j} + \varepsilon_{1t} \quad (2)$$

$$OIL_t = \alpha + \sum_{j=1}^{m} \vartheta_j GDP_{t-j} + \sum_{j=1}^{m} \mu_j OIL_{t-j} + \sum_{j=1}^{m} \varphi_j CPI_{t-j} + \varepsilon_{2t} \quad (3)$$

$$CPI_t = \alpha + \sum_{j=1}^{m} \omega_j GDP_{t-j} + \sum_{j=1}^{m} \partial_j OIL_{t-j} + \sum_{j=1}^{m} \sigma_j CPI_{t-j} + \varepsilon_{3t} \quad (4)$$

4.2.2. Unit Root Test

The long-term characteristic of a series is determined by the value of the varible in current and past period. And current value is related to its value in previous period. Therefore, to understand the progress of the series, it is necessary to find the regression of the value of the series with the values of the previous periods. For this reason, whether the series are stationary in econometrics can be determined by the unit root analysis. (Tarı, 1999, 368-369).

The relationship of the value of the Y_t variable in this period between the value of Y_{t-1} variable in the past period;

$$Y_t = \mathrm{P}.\mathrm{Y}_{t-1} + \mathrm{u}_t \quad (5)$$

Here, u_t is a stochastic error term. This model is the first order autoregressive AR(1) model. In this regression, if the P coefficient is found to be equal to one (P=1) the unit root problem emerges and its relation,

$$Y_t = \mathrm{Y}_{t-1} + \mathrm{u}_t \quad (6)$$

This means that the value of the variable in the previous period and therefore the shock to which it was exposed in that period remain in the system. Considering this for the whole period, since the above result is valid for all periods, it means that the effect of the variable on the value of this period continues in the shocks occuring in the previous periods and therefore consists of a sum of all shocks in the past. The permanent nature of these shocks means that the series is non-stationary and the trend over time is random.

If the P coefficient is smaller than one, even if the shocks in the previous periods continue to affect for a certain period, this effect will gradually decrease and will disappear completely after a short period of time.

(6) by subtracting Y_{t-1} from the right and left sides of the equation,

$$\Delta Y_t = (\mathrm{P} - 1)\mathrm{Y}_{t-1} + \mathrm{u}_t \quad (7)$$

can be obtained. Here $\Delta Y_t = Y_t - Y_{t-1}$ (first difference). (P-1) can be expressed as δ the relationship will be,

$$\Delta Y_t = \delta Y_{t-1} + u_t \quad (8)$$

If P=1, it becomes δ=0 . If δ=0 ,

$$\Delta Y_t = (Y_t - Y_{t-1}) = u_t \quad (9)$$

And so ΔY_t (first difference) will be stationary. Thus if the first difference of an original series is stationary, the original level is called adapted from the first order. If it is necessary to take the difference twice in order to maket he series statinoray, it is written as I(2) and if it is necessary to take b times difference it is written as I(b). In this case, a non-stationary series can be converted to stationary by taking its difference.

This process eliminates the effect of the permanent shock contained in the series and ensures that the temporary shocks remain stationary, that is, approaching a certain value, thus making the series stable. (Güngör, 2016, 60-68).

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used. These two unit root tests were used to determine the stationary of the variables.

4.2.2.1. Dickey Fuller (DF) Test

The Dickey Fuller Test was developed to test whether variables are stationary or not (Uygur, 2001: 187-189):

$$Y_t = \beta_1 + \beta_2 T + u_t \quad (10)$$

Let's express it with $u_t = pu_{t-1} + e_t$, considering that the trend equation and the error term are correlated. Where T is incremental time variable for each period 1.

Now let's put $u_t = pu_{t-1} + e_t$ relationship to trend equation of Y. It can be found;

$$Y_t = \beta_1 + \beta_2 T + pu_{t-1} + e_t \quad (11)$$

$$u_t = Y_t - \beta_t - \beta_2 T \quad (12)$$

$$u_{t-1} = Y_{t-1} - \beta_1 - \beta_2 T(-1) \quad (13)$$

If we put the expression we obtained for u_{t-1} into the Yt equation;

$$Y_t = \beta_1(1-p) + p\beta_2 + \beta_2(1-p)T + pY_{t-1} + e_t \quad (14)$$

Now subtracting Y_{t-1} from both sides

$$Y_t - Y_{t-1} = \beta_1(1-p) + p\beta_2 + \beta_2(1-p)T + \gamma Y_{t-1} + e_t \quad (15)$$

In this equation γ=p−1.

To estimate the above equation, and then to test the results of the prediction can be expressed as follows;

$$\Delta Y_t = \alpha + \theta T + \gamma Y_{t-1} + e_t \quad (16)$$

If this equation is estimated by OLS method, H_0: γ=0 hypothesis can be tested easily. Since γ=p−1 if; H_0: γ=0 this means, p=1.

In this case there is a unit root. However, usual t-statistics and tables cannot be used to test this hypothesis. The Dickey Fuller distribution and critical values should be used instead.

4.2.2.2. Augmented Dickey - Fuller (ADF) Test

The three model patterns considered in the DF test, including the lagged values of the dependent variable in the model, Augmented Dickey Fuller (ADF) regressions are written as in the following equations (İğde, 2010, 16-17).

$$\Delta Y_t = \delta Y_{t-1} + \sum_{j=2}^{k} \delta_j \Delta Y_{t-j+1} + e_t \quad (17)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{j=2}^{k} \delta_j \Delta Y_{t-j+1} + e_t \quad (18)$$

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{j=2}^{k} \delta_j \Delta Y_{t-j+1} + e_t \quad (19)$$

In the regressions δ=0 is tested.

If, H_0: δ=0 the unit has root

If, H_1: δ<0 the unit does not have root

If the H_0 hypothesis is rejected, it is concluded that the series is stationary at the original level and the H_0 hypothesis cannot be rejected, the series is not stationary.

4.2.2.3. Phillips-Perron (PP) Test

In the Dickey-Fuller tests, it is accepted that error terms have independent, normal distribution and constant variance. In the studies, the attention is paid to the existence of this relationship. Phillips and Perron (1988) slightly softened this assumption,

which was adopted in the Dickey-Fuller procedure by a method they developed. (Kutlar, 2007, 335).

Considering the following equation models,

$$Y_t = \mathrm{m}_0 + \mathrm{m}_1 \mathrm{y}_{t-1} + \mathrm{e}_t \quad (20)$$

$$y_t = \mathrm{m}*_0 + \mathrm{m}*_1 \mathrm{y}_{t-1} + \mathrm{m}*_2 \left(t - \frac{T}{2}\right) + \mathrm{e}_t \quad (21)$$

T represents the number of observations in the equations. Since et, E(et)=0, there is no requirement that the disruptive terms are not in a series correlation relationship or are not homogeneous. The Phillips and Peron (PP) test permits weak dependence and heterogeneity among the disturbing terms in contrast to the DF test. PP test,

$$y_t = \mathrm{y}_{t-1} + \mathrm{e}_t \quad (22)$$

For the data generated in the process, the null hypothesis test is applied against the coefficients m and m $*$ and m1.

For the data generated in the process, the null hypothesis test is applied against the coefficients m, m$*$ and m1

4.2.3. VAR (Vector Autoregression) Model

The model developed by Sims is based on the Granger causality test and if there are two endogeneous variables in the model, each of these is associated with the lagged values of both its own and the other endogeneous variable up to a certain period. Sims criticizes the endogeneous-exogeneous distinction in the structural model. It also states that distinction is artificial. Accordind to Sims, if there is true simultaneity among a set of variables, they should all be treated on an equal footing; there should not be any priori distinction between endogenous and exogenous variables. Considering the Y_t ve X_t series in VAR model can be shown as (Gujurati, 2004, 848; Ertek, 2000, 404),

$$\mathrm{Y}_t = \alpha + \sum_{j=1}^{m} \beta_j Y_{t-j} + \sum_{j=1}^{m} \delta_j X_{t-j} + \varepsilon_{1t} \quad (23)$$

$$X_t = \alpha + \sum_{j=1}^{m} \theta_j Y_{t-j} + \sum_{j=1}^{m} \vartheta_j X_{t-j} + \varepsilon_{2t} \quad (24)$$

Here, ε_1 and ε_2 are the error terms. The lagged values of Y affect the X variable and the lagged values of X affect the Y variable. Since only lagged variables are located

on the right side of the equations in this model, the values can be estimated by the least squares method.

After the appropriate lag lengths are found in the VAR system, the impulse-response function is switched on. IR functions show the effects of shocks on variables and their representation at what time and by means of tables or graphs.

With this process, it is understood in which variable the shocks occur and what the variables will react to these shocks. In order to determine how shocks occur, the movements of the variables within 10 periods are examined first. The responses of the other series against the 1 unit change in the shocks occurring in the series are presented with the help of graphs. The same results can be given as a table. The columns represent the variables in which shocks occur, while the rows indicate the responses of the variables to these shocks. (Tarı, 2010, 465-468).

4.2.4. Granger Causality Test

Granger causality test between variables is based on time series data. The Granger test is explained as follows from the relationship between X and Y. Before the test, the following equations are estimated (Akkaya, 1991: 175-176):

$$X_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{j=1}^{n} \beta_i X_{t-j} + u_{1t} \quad (25)$$

$$Y_t = \sum_{i=1}^{m} \theta_i Y_{t-i} + \sum_{j=1}^{m} \vartheta_i X_{t-j} + u_{2t} \quad (26)$$

Here, it is assumed that u_{1t} and u_{2t} error terms are not related with each other. (25) equation shows that X is dependant on; X's past values Y's past values. (26) equation shows that Y is dependant on; past Y and X variables. Regarding the effects of X and Y variables on each other, there are 4 different states from the regressions (25) and (26).:

1. Y's one way effect on X' (Y→X)

This situation; This is the case if the parameters of the lagged Y in equation (25) are statistically different from zero and the set of lagged X parameters in (26) is statistically non-zero.

2. X's one way effect on Y (X→Y)

And (25) the lagged X variable parameter set is statistically different from zero. And (26) the delayed variable X is the case where the parameter set is statistically non-zero.

3. X and Y's effect each other (X↔Y)

In both equations, if the lagged Y and X parameter sets are statistically significant, that is different from zero If $\Sigma\alpha_i \neq 0$, $\Sigma\beta_j \neq 0$, $\Sigma\varphi_i \neq 0$, $\Sigma\delta_j \neq 0$, it is decided that the two variables affect each other mutually.

4. X and Y does not affect each other, independent

This is the case if the parameter sets of lagged variables are equal to zero.

4.2.5. Cointegration Test

Cointegration between the two variables indicates a long-term equilibrium relationship between the two series. In other words, cointegration is the study of the long-term relationship of variables. However, there may not be a balance between the two variables in the short term.

The error terms found in this case provide a bridge between short-term values and long-term values. The error correction model has been developed for this purpose. The error correction model of the cointegrated series is briefly represented by the ECM. Assuming that the variables Y and X are cointegrated, we can simplify the error correction model as follows: (Dikmen, 2012, 331-332).

$$\Delta Y_t = a_0 + a_1 X_t + a_2 u_{t-1} + v_t \quad (27)$$

Here ΔY_t tells us the short term fluctuations in the variable X_t, u_{t-1} refers to the adjustment to the long term equilibrium. The coefficient α_2 indicates the deviation, also called adjustment or adaptation speed. If α_2 is statistically significant, it indicates the extent to which the short term imbalance in x_t can be corrected after one period. If α_2 is positive deviating from the balance, if negative deviation approaches the long-term value. In other words it can be said that the error correcting mechanism works and the deviation decreases.

4.3. Data and Emprical Results

In this study, the relationship between gross domestic product (GDP), oil prices (OIL) and consumer price index (CPI) is examined between the period 2003: Q1-2018:Q4. Data was obtained from the official website of Central Bank's of"https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket"at 01.06.2019.

Eviews 10 program was used to analyze the causality of the relationship between variables. All of the variables were analyzed by taking the natural logarithm.

The followings were performed with the obtained data,

1. Unit Root Test (ADF ve PP tests),
2. Johansen cointegration test,
3. Impulse-Response Functions,
4. Variance Decomposition Analysis,
5. Granger causality test.

4.3.1. Preliminary Analysis

Analyzes with basic variable data do not always give a healthy result. The distribution of data, values, whether it contains trend and seasonality play an important role in time series analysis. If the distribution of data and the presecence of trend is not reflected in the model, the model specification error occurs. Therefore, descriptive statistics of the series should be examined in order to examine the structure of the data.

Firstly, the natural logarithm of these three variables (GDP, OIL, CPI) was depicted in Figure 8. In time series anlaysis, seasonality should be taken in consideration. Therefore, Therefore, the Tramo/Seats method was used to eliminate the seasonal effects when necessary. As a result of Tramo/Seat analysis, it was observed that there is no seasonality in OIL but there was seasonal components in GDP and CPI series.

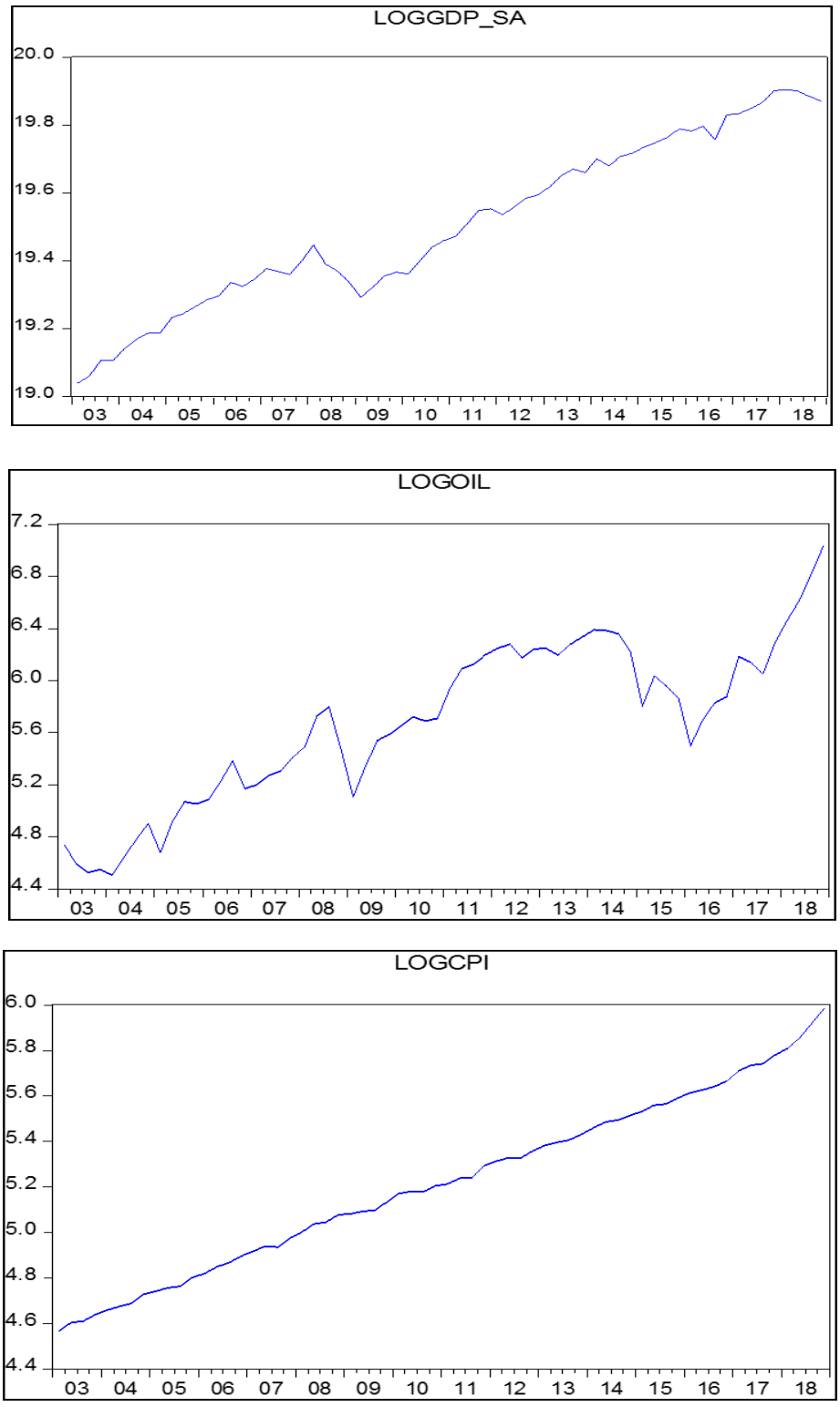


Figure 8: Logarithmic Graphs of the Variables

Correlation analysis was performed to determine the linear strength and direction of the association between the variables and the results are given in Table 1.

Table 1: Correlation Matrix

	DLOGGDP_SA	DLOGCPI	DLOGOIL
DLOGGDP_SA	1	-0.10925	0.134658
DLOGCPI	-0.10925	1	0.441914
DLOGOIL	0.134658	0.441914	1

In the Table 1, the correlation between the variables was tried to be determined by correlation matrix. It is seen that there is a negative (opposite) relationship between CPI and growth. And this relationship insignificant at 5% level. It was found that there is a positive relationship between oil prices and inflation and between growth and oil prices. There is no significant relationship between the variables at the 5% level.

The main statistical results of GDP, OIL and CPI variables are given in Table 1.

Table 2: Basic Statistical Information about Variables

	LOGGDP_SA	LOGOIL	LOGCPI
Mean	19.50517	5.682677	5.218174
Medium	19.46499	5.72503	5.209313
Maximum	19.90434	7.030044	5.983634
Minimum	19.03904	4.503691	4.568195
Std. Dev.	0.245997	0.617269	0.379933
Skewness	0.024046	-0.22619	0.061461
Kurtosis	1.871894	2.232486	1.978904
Jarque-Bera	3.399827	2.116619	2.820659
Probability	0.182699	0.347042	0.244063
Total	1248.331	363.6913	333.9632
Error Sum of Squares	3.812411	24.00429	9.093991

4.3.2. Unit Root Test Results

In a time series model, it is necessary to know whether the stochastic process changes over time. If the quality of the stochastic process changes over time, that is, the series is not stationary, the autocorrelations deviate significantly from zero (Kutlar, 2009, 262).

In this section, first of all, unit root tests are applied to determine the integration order of the series. Since the ADF and PP tests were performed with quarterly data, the maximum lag lenght was assumed to be 4.

Table 3: ADF Unit Root Test Results by Variables

Variables	**Unit Root**	**Test Aquation**	**t-stat**	**p-value**
loggdp	Level	Constant and No Trend	1.643772	0.9744
		Constant	-0.93239	0.7711
		Constant and Trend	-3.05387	0.127
	First Difference	Constant and No Trend	-2.10488	0.0349**
		Constant	-2.80253	0.0641***
		Constant and Trend	-2.7894	0.207
logoil	Level	Constant and No Trend	1.748073	0.9795
		Constant	-1.05477	0.7278
		Constant and Trend	-2.35578	0.3983
	First Difference	Constant and No Trend	-2.56921	0.011**
		Constant	-3.1388	0.0291**
		Constant and Trend	-3.05544	0.1267
logcpi	Level	Constant and No Trend	1.337166	0.9529
		Constant	1.811611	0.9997
		Constant and Trend	0.701611	0.9996
	First Difference	Constant and No Trend	0.765999	0.8765
		Constant	-0.95202	0.7644
		Trend	-1.19402	0.9023

*: p<0.01; **: p<0.05; ***: p<0.1 significance level.

As a result of ADF test shown in Table 3, it is seen that loggdp, logoil and logcpi series contain unit root at all statistical significance levels, that is, they are not stationary in levels. In the first difference of loggdp and logoil are stationary, it means that they are I(1). According to the ADF test results for logcpi, the series contain a unit root, i.e. it is non-stationary. It is concluded that loggdp and logoil series are I(1) series. But logcpi semms to be I(2).

Table 4: PP Unit Root Test Results by Variables

Variables	Unit Root	Test Aquation	t-statistics	p-value
Loggdp	Level	Constant and No Trend	2.34653	0.9951
		Constant	-1.7136	0.4196
		Constant and Trend	-6.65148	0.0000*
	First Difference	Constant and No Trend	-10.7933	0.0000*
		Constant	-12.2659	0.0000*
		Constant and Trend	-12.1192	0.0000*
Logoil	Level	Constant and No Trend	1.806948	0.9821
		Constant	-0.38723	0.9045
		Constant and Trend	-2.0983	0.5366
	First Difference	Constant and No Trend	-6.70216	0.0000*
		Constant	-7.02533	0.0000*
		Constant and Trend	-6.9733	0.0000*
Logcpi	Level	Constant and No Trend	11.95558	1.0000
		Constant	1.741965	0.9996
		Constant snd Trend	1.067175	0.9999
	First Difference	Constant and No Trend	-2.50625	0.0129**
		Constant	-7.00673	0.0000*
		Constant and Trend	-7.33397	0.0000*

*: p<0.01; **: p<0.05; ***: p<0.1 significant at this level.

According to the result of the PP test seen in Table 4, all of the variables are I(1), i.e. they are not staionary in levels. But their first diferences become staionary.

When the ADF and PP unit root tests were evaluated together, it was found that all series (loggdp, logoil and logcpi) were not stationary in levels and they are all I(1).

The first differences of these series (dloggdp, dlogoil and dlogcpi) are graphed in Figure10.

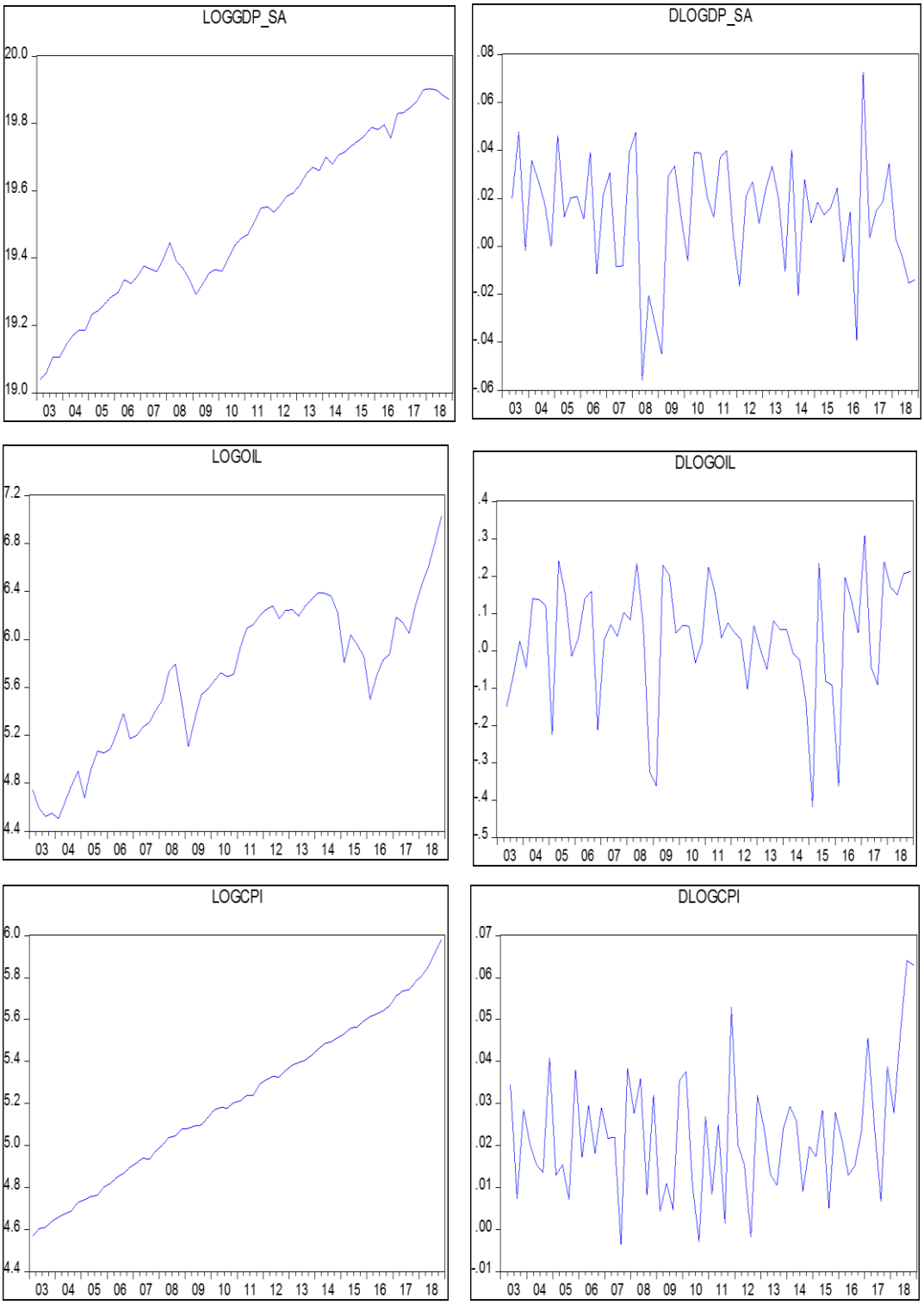


Figure 9: The variables in levels and first differences

As a result of unit root analysis of all series in the first difference I(1), it is necessary to determine the correct lag length for the model to be used in Johansen cointegration analysis and vector error correction model.

Since the data set of our research series consisted of quarter data, the delay length up to 5 periods was examined. As shown in Table 5, in all the information criteria (FPE, AIC, LR, AIC, SC and HQ), it is determined that determined 8 lag lengths as the optimal lag length. As shown in table 4, FPE has determined 4 lag lenghts as the optimal lag length in AIC and LR information criteria. In SC and HQ information criteria, no lag lenght was determined. The SC (Schwarz) information criterion often leads to omitted variable bias because it finds less latencyand since we use the Akaike information criterion for unit root tests in the analysis, the model with four lags will be checked for cointegration testing.

VAR model estimates and equations are given in Table 4.

Table 5: VAR Model Lag Lenght Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	305.2849	NA	3.38E-09	-10.9922	**-10.88269***	**-10.94984***
1	310.0985	8.92702	3.94E-09	-10.8399	-10.402	-10.6706
2	319.7056	16.76876	3.86E-09	-10.862	-10.0956	-10.5656
3	324.9636	8.604013	4.46E-09	-10.726	-9.63104	-10.3025
4	346.7572	**33.28475***	**2.85e-09***	**-11.19117***	-9.76779	-10.6407
5	352.2624	7.807403	3.31E-09	-11.0641	-9.31223	-10.3866
6	358.2061	7.780917	3.84E-09	-10.953	-8.87262	-10.1485
7	361.7176	4.213711	4.94E-09	-10.7534	-8.34457	-9.82186
8	376.9527	16.62011	4.24E-09	-10.9801	-8.24282	-9.92157

* indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

VAR model estimates and equations formed after determining the lag length are given in Table 5.

Table 6: VAR Model

Model Estimation:

LS 1 4 DLOGGDP_SA DLOGCPI DLOGOIL

VAR Model:

DLOGGDP_SA = C(1,1)*DLOGGDP_SA(-1) + C(1,2)*DLOGGDP_SA(-2) + C(1,3)*DLOGGDP_SA(-3) + C(1,4)*DLOGGDP_SA(-4) + C(1,5)*DLOGCPI(-1) + C(1,6)*DLOGCPI(-2) + C(1,7)*DLOGCPI(-3) + C(1,8)*DLOGCPI(-4) + C(1,9)*DLOGOIL(-1) + C(1,10)*DLOGOIL(-2) + C(1,11)*DLOGOIL(-3) + C(1,12)*DLOGOIL(-4) + C(1,13)

DLOGCPI = C(2,1)*DLOGGDP_SA(-1) + C(2,2)*DLOGGDP_SA(-2) + C(2,3)*DLOGGDP_SA(-3) + C(2,4)*DLOGGDP_SA(-4) + C(2,5)*DLOGCPI(-1) + C(2,6)*DLOGCPI(-2) + C(2,7)*DLOGCPI(-3) + C(2,8)*DLOGCPI(-4) + C(2,9)*DLOGOIL(-1) + C(2,10)*DLOGOIL(-2) + C(2,11)*DLOGOIL(-3) + C(2,12)*DLOGOIL(-4) + C(2,13)

DLOGOIL = C(3,1)*DLOGGDP_SA(-1) + C(3,2)*DLOGGDP_SA(-2) + C(3,3)*DLOGGDP_SA(-3) + C(3,4)*DLOGGDP_SA(-4) + C(3,5)*DLOGCPI(-1) + C(3,6)*DLOGCPI(-2) + C(3,7)*DLOGCPI(-3) + C(3,8)*DLOGCPI(-4) + C(3,9)*DLOGOIL(-1) + C(3,10)*DLOGOIL(-2) + C(3,11)*DLOGOIL(-3) + C(3,12)*DLOGOIL(-4) + C(3,13)

VAR Model - Substituted Coefficients:

DLOGGDP_SA = - 0.129084116309*DLOGGDP_SA(-1) - 0.0591226249721*DLOGGDP_SA(-2) + 0.0560191422002*DLOGGDP_SA(-3) + 0.244702650404*DLOGGDP_SA(-4) - 0.591303261527*DLOGCPI(-1) - 0.617475467378*DLOGCPI(-2) - 0.501902837731*DLOGCPI(-3) - 0.458994345265*DLOGCPI(-4) - 0.00545962218078*DLOGOIL(-1) + 0.0213299142182*DLOGOIL(-2) - 0.0262797267258*DLOGOIL(-3) + 0.0307541767006*DLOGOIL(-4) + 0.0555739462276

DLOGCPI = 0.0591963372091*DLOGGDP_SA(-1) + 0.00138737556639*DLOGGDP_SA(-2) - 0.0182162139869*DLOGGDP_SA(-3) - 0.059417892942*DLOGGDP_SA(-4) + 0.129313718533*DLOGCPI(-1) + 0.271323470227*DLOGCPI(-2) - 0.0232227441284*DLOGCPI(-3) + 0.66696235079*DLOGCPI(-4) + 0.0283217436517*DLOGOIL(-1) + 0.0165312250931*DLOGOIL(-2) + 0.0259697893354*DLOGOIL(-3) - 0.0333507859689*DLOGOIL(-4) - 0.000624629717635

DLOGOIL = 1.85423741868*DLOGGDP_SA(-1) + 0.276392189027*DLOGGDP_SA(-2) + 0.322828446987*DLOGGDP_SA(-3) - 1.66124952595*DLOGGDP_SA(-4) + 0.217345128727*DLOGCPI(-1) + 2.14789116319*DLOGCPI(-2) - 1.63952905736*DLOGCPI(-3) - 0.416527004631*DLOGCPI(-4) + 0.11512444568*DLOGOIL(-1) - 0.223426891954*DLOGOIL(-2) + 0.0675612430239*DLOGOIL(-3) + 0.110176223383*DLOGOIL(-4) + 0.0247026373903

4.3.3. Johansen Cointegration Test Results

Johansen Cointegration test uses maximum eigenvalue and trace statistics to test whether there is a long term relationship between variables according to maximum likelihood approach. Prior to the cointegration test, Akaik and Schwarz information criteria tests are conducted to check whether there is a cointegration. Among these two criteria, the model with the lowest value of asterisk (*) is the ideal model for us.

Table 7: Johansen Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.227869	24.83186	29.79707	0.1675
At most 1	0.139534	9.833021	15.49471	0.2938
At most 2	0.01907	1.116715	3.841466	0.2906

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.227869	14.99884	21.13162	0.289
At most 1	0.139534	8.716305	14.2646	0.3105
At most 2	0.01907	1.116715	3.841466	0.2906

When Table 7 is examined, it is seen that there is no cointegration equation between the variables since both trace statistics values (24.83) and maximum eigenvalues (14.99) are less than critical values (29.79 and 21.13) and there is no significance at both 5% and 1% significance level. As a result of these results, there is no statistical relationship between variables in the long run.

In order to test whether VAR model has dignostic problems, Breusch-Godfrey Serial Correlation LM Test and White Heteroskedasticity Test were applied. The test results are given in Table 9, 10.

Table 8: Autocorrelation Test Results

VAR Residual Serial Correlation LM Tests

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	11.12026	9	0.2676	1.260309	(9, 99.9)	0.2680
2	2.493753	9	0.9811	0.270961	(9, 99.9)	0.9811
3	5.964787	9	0.7434	0.659151	(9, 99.9)	0.7437
4	15.13427	9	0.0873	1.749560	(9, 99.9)	0.0876
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	11.12026	9	0.2676	1.260309	(9, 99.9)	0.2680
2	14.80736	18	0.6751	0.816927	(18, 108.0)	0.6769
3	17.63727	27	0.9142	0.629334	(27, 102.9)	0.9160
4	31.97074	36	0.6607	0.871858	(36, 95.3)	0.6724

According to Autocorrelation test results given in Table 8, LM test was applied to determine whether autocorrelation exits in the error terms in the estimated VAR model. According to the results of this test, there were no autocorrelations for all four 4 lags .

Then, White Heteroscedacity Test, which is one of several tests, was applied to determine the variance problem. The test results are shown in Table 10.

Table 9: Heteroscedacity Test Results

Joint test:

Chi-sq	Df	Prob.
158.2716	144	0.1966

Individual components:

Dependent	R-squared	F(24,34)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.366009	0.817856	0.6927	21.59455	0.6035
res2*res2	0.524048	1.559823	0.1149	30.91882	0.1561
res3*res3	0.439003	1.108600	0.3845	25.90118	0.3582
res2*res1	0.452396	1.170359	0.3310	26.69134	0.3190
res3*res1	0.653460	2.671371	0.0043	38.55417	0.0304
res3*res2	0.614689	2.260015	0.0144	36.26664	0.0517

The chi-square value at Table 9 shows that there is no variance problem in the estimated model, i.e. the variance for error term is same for all observations. When the probability value of the model is considered, it is seen that p value (0.1966) is

greater than 0.05 (5%). This shows there is no heteroscedasticity problem in the model.

4.3.4. Impulse-Response Graphs

Impulse-response analysis shows the impulse-response function graphs within ± 2 standard error confidence intervals obtained as a result of VAR model estimation, which shows the effects of shocks on variables and at what time. If stability is the case in question, the shocks given to the variables will disappear over time.

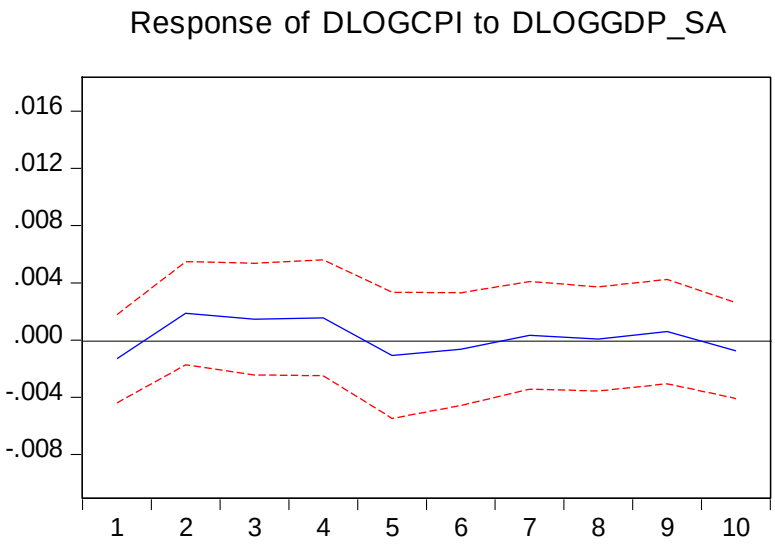


Figure 10: Response of DLOGGDP_SA to DLOGCPI

A standard error in the variable DLOGGDP_SA shows the response of the shock to the variable DLOGCPI. The impact of one unit of shock on the first period of growth (DLOGGDP_SA) causes a negative and increasing response to inflation (DLOGCPI). In the 2nd period, it causes a positive and increasing response in the period. After the third period, it is seen that the equilibrium value remains constant and does not cause any reaction.

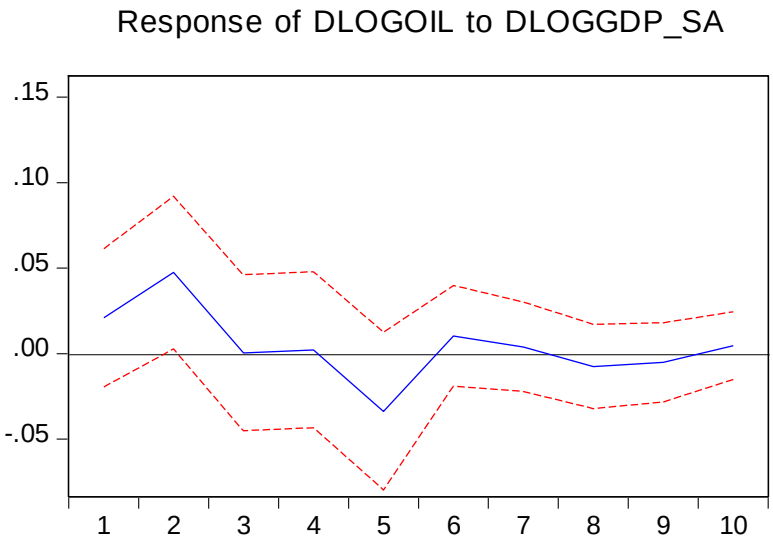


Figure 11: Response of DLOGGDP_SA Variable to DLOGOIL

A standard error in the variable DLOGGDP_SA indicates the response of the shock to the variable DLOGOIL. The effect of one-unit shock on growth (DLOGGDP_SA) during the first two periods leads to a positive and decreasing reaction to oil prices (DLOGOIL).

In the third period, the reaction was positive but declining again. In the 4th and 5th Periods, the reaction was negative and decreased first and then increased. After the 6th period, the reaction was again observed with slight deviations in equilibrium.

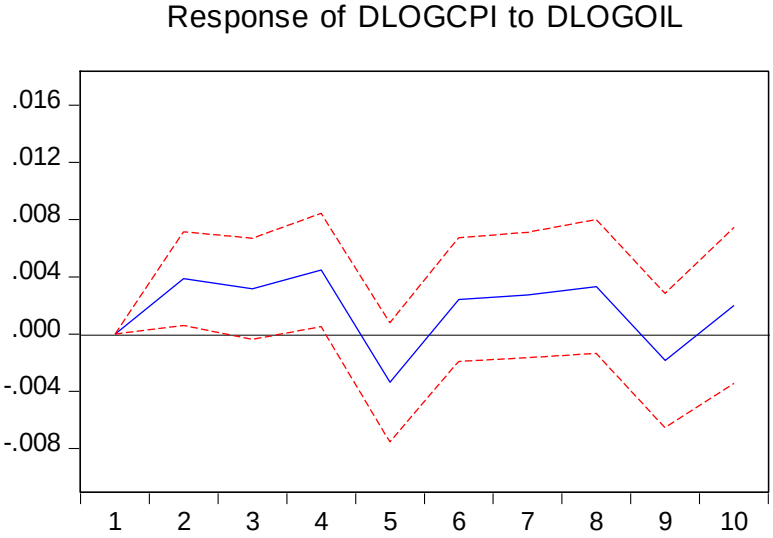


Figure 12: Response of DLOGOIL Variable to DLOGCPI

A standard error in the variable DLOGOIL shows the response of the shock to the variable DLOGCPI. During the first two periods, the impact of one-unit shock in oil prices (DLOGOIL) causes a positive and increasing response to inflation (DLOGCPI). The response of the variable remains positive in the positive direction after the 2nd period until the 4th period. After the 4th period, it decreases rapidly

until the 5th period and becomes negative. It is seen that the trend (increasing-constant-decreasing) continues in the same way in the following periods.

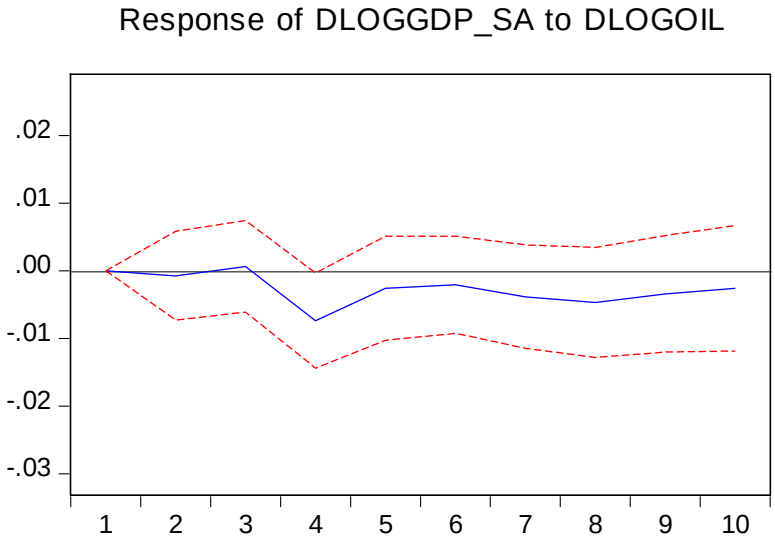


Figure 13: Response of DLOGOIL Variable to DLOGGDP_SA

A standard error in the variable DLOGOIL indicates the response of the shock to the variable DLOGGDP_SA. During the first three periods, the impact of one unit of shock on oil prices (DLOGOIL) did not affect the growth (DLOGGDP_SA P) variable and remained at equilibrium value. The variable reacted negatively and decreasing after increasing in the 3rd and 5th periods. After the 5th period, the response is consistently negative.

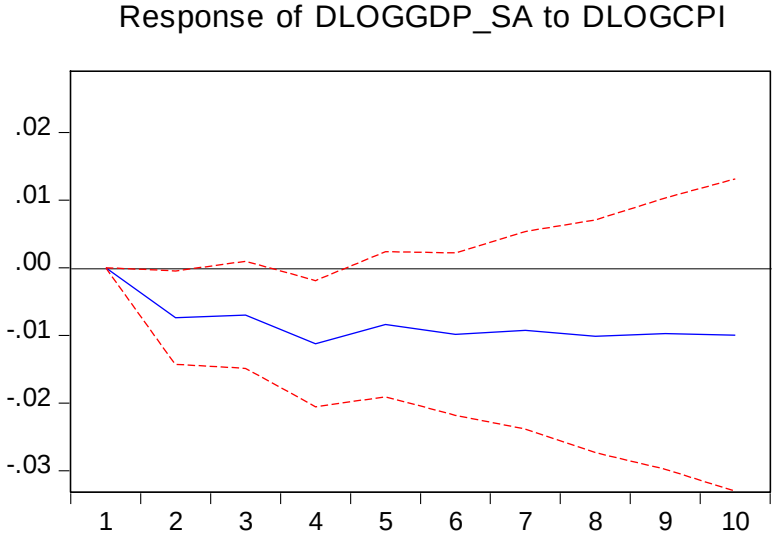


Figure 14: Response of DLOGCPI Variable to DLOGGDP_SA

A standard error in the DLOGCPI variable indicates the response of the shock to the DLOGGDP_SA variable. In general, the effect of one-unit shock on inflation (DLOGCPI) in all periods leads to a negative response to the growth variable

(DLOGCPI). The reaction gradually decreases until the 5th period. 5. After the period, there is a negative tendancy constant trend in the variable.

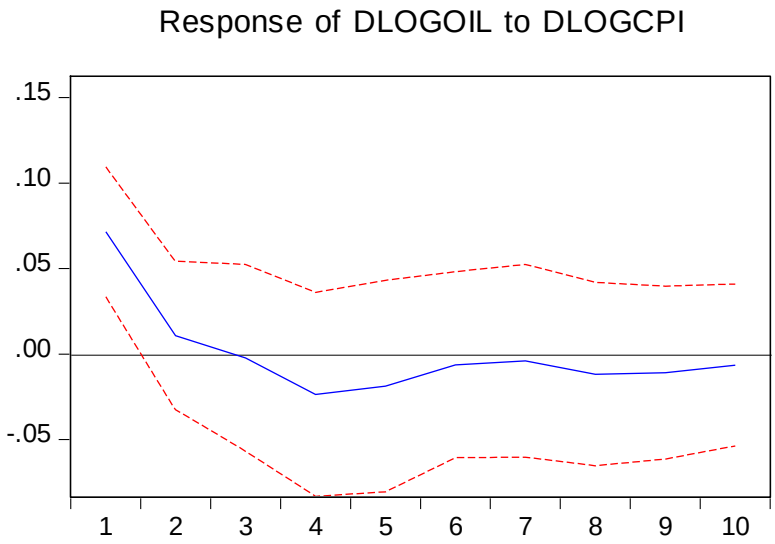


Figure 15: Response of DLOGCPI Vairable to DLOGOIL

A standard error in the DLOGCPI variable indicates the response of the shock to the DLOGOIL variable. In the first two periods, the response is positive and decreasing. After the third period, a negative tendancy with a constant trend emerges.

When the Impact-Response analysis result is evaluated in general, one unit of standard error shock in any variable causes a general reaction in other variables as well. Moreover, most of the reactions are negative. In particular, the impact of the unit shock in oil prices on inflation was continuous and the unit shock in inflation had a negative impact on growth.

4.3.5. Variance Decomposition Results

The results of variance decomposition that analyze how much of a change in a variable is caused by itself and how much of a variable caused by other variables are shown in Tables 10, 11, 12.

Table 10: DLOGCPI Variable's Variance Decomposition Test Results

Variance Decomposition of DLOGCPI:

Period	S.E.	DLOGCPI	DLOGGDP_SA	DLOGOIL
1	0.011902	100	0	0
2	0.013147	88.3821	2.930271	8.687631
3	0.014398	83.60386	4.321466	12.07468
4	0.015425	75.83166	5.207084	18.96125
5	0.016961	76.02245	4.361329	19.61623
6	0.017331	75.05599	4.219268	20.72474
7	0.018014	74.43227	4.090007	21.47772
8	0.018616	72.82017	3.883725	23.29611
9	0.01956	74.1012	3.902372	21.99643
10	0.019905	73.92613	3.810808	22.26306

According to the variance decomposition table of DLOGCPI series; It has been observed that DLOGGDP_SA and DLOGOIL variables have increased power to explain DLOGCPI variable over time. The growth rate of inflation (CPI) was 2.9 % in the second quarter, while the oil prices (OIL) had a 8.6% explanation in the same period. In the 10th period, DLOGGDP_SA variable's power to explain DLOGCPI variable is 3.81%, and DLOGOIL's power to explain DLOGCPI variable is 22.2 %. According to these results; oil prices have a higher rate of explanation than inflation. Inflation was more affected by its internal dynamics throughout the period. In addition, CPI is an external variable since it explains 100% of the change in variance on its own.

Table 11: DLOGGDP Variable's Variance Decomposition Test Results

Variance Decomposition of DLOGGDP_SA:

Period	S.E.	DLOGCPI	DLOGGDP_SA	DLOGOIL
1	0.024442	1.19349	98.80651	0
2	0.025667	8.667729	91.24757	0.0847
3	0.026637	14.5841	85.27998	0.135918
4	0.029849	25.80182	67.94062	6.257563
5	0.031256	31.19717	62.41921	6.383624
6	0.032861	36.81213	57.01631	6.171555
7	0.034389	40.52843	52.5905	6.88107
8	0.036201	44.62293	47.49317	7.883893
9	0.037643	47.85956	44.01945	8.12099
10	0.039033	50.85807	41.15003	7.991905

When the variance decomposition table of DLOGGDP_SA variable is examined, it is observed that the power of DLOGCPI and DLOGOIL variables to explain DLOGGDP_SA variable over time. In the early stages, growth is significantly affected by its shocks. But this decreases over time.

Although the power of DLOGOIL to explain the DLOGGDP variable increased in the first five periods, there was a decrease in the variable in the 6th period and then it increased again. In the 10th period, DLOGCPI variable has 50.85% power for explaining DLOGGDP_SA and DLOGOIL has 7.99% power for explaining. Inflation's ability to explain growth is about 5.5 times that of oil prices. The internal dynamics of growth decreased over time and the effect of inflation on growth increased further. In the 10th period inflation has the power to further explain growth in the period.

Table 12: Variance Decomposition Test Results of DLOGOIL

Variance Decomposition of DLOGOIL:

Period	S.E.	DLOGCPI	DLOGGDP_SA	DLOGOIL
1	0.155837	19.52884	3.38698	77.08418
2	0.164019	17.74419	11.74793	70.50788
3	0.166631	17.21127	11.38269	71.40604
4	0.168756	18.74823	11.09822	70.15355
5	0.173504	18.47615	14.69975	66.8241
6	0.173997	18.54919	14.92494	66.52587
7	0.176477	18.09183	14.54827	67.3599
8	0.177511	18.25371	14.6226	67.12369
9	0.178045	18.47261	14.65856	66.86883
10	0.17844	18.54073	14.64098	66.81829

When the analysis of variance decomposition of DLOGOIL variable is examined, the power of explaining DLOGOIL variable is 19.5 % and the power of explaining DLOGGDP_SA is 3.38 % in the first period. In the 10th period, DLOGCPI variable has the power of explaining DLOGOIL variable to 18.54% and DLOGGDP_SA has the power to explain DLOGOIL to 14.64 %. The DLOGCPI variable has more power to explain the DLOGOIL variable than the DLOGGDP_SA variable.

In addition, self-disclosure power of oil prices is higher than other variables during the period.

4.3.6. Granger Causality Test Results

If there is a time-dependent relationship between any two variables, the causality of this relationship can be determined statistically. The most widely used method is the Granger Causality Test.

In this study, Granger Causality Test is applied. It is developed by Granger and Engle. It was used to determine the existence and direction of the relationship between variables. As a result of the tests, the results found in Table 13 were obtained.

Table 13: Granger Causality Test Results at Different Lags

Excluded	Chi-sq	df	Prob.
Dependent variable: DLOGGDP_SA			
DLOGOIL	0.000639	1	0.9798
DLOGCPI	2.409708	1	0.1206
DLOGOIL	0.423896	2	0.809
DLOGCPI	4.917936	2	0.0855
DLOGOIL	1.113371	3	0.7738
DLOGCPI	2.584743	3	0.4602
DLOGOIL	3.071446	4	0.5459
DLOGCPI	6.511143	4	0.1641
Dependent variable: DLOGOIL			
DLOGGDP_SA	3.0174	1	0.0824
DLOGCPI	0.000387	1	0.9843
DLOGGDP_SA	4.430322	2	0.1091
DLOGCPI	2.83134	2	0.2428
DLOGGDP_SA	4.128263	3	0.2479
DLOGCPI	4.253874	3	0.2353
DLOGGDP_SA	7.343348	4	0.1188
DLOGCPI	2.853974	4	0.5826
Dependent variable: DLOGCPI			
DLOGGDP_SA	0.615971	1	0.4325
DLOGOIL	1.257889	1	0.2621
DLOGGDP_SA	0.990473	2	0.6094
DLOGOIL	7.47536	2	0.0238
DLOGGDP_SA	0.737819	3	0.8643
DLOGOIL	11.34908	3	0.01
DLOGGDP_SA	1.382171	4	0.8473
DLOGOIL	23.07709	4	0.0001*

As seen in Table 15, it is seen that there is a significant one-way and $p<0.01$ causality relationship from the independent variable oil prices (DLOGOIL) to the dependent variable cpi (DLOGCPI). There is no causal relationship between the other variables. This relationship is shown graphically in Figure 15 at the 4th lag.

The same variables (DLOGOIL > DLOGCPI) were found to be significant at p<0.01 in the second and third lag.

From CPI to GDP growth, there is a very weak (p<0.1) causality in 2nd lag. From GDP growth to oil prices, there is a weak (p<0.1) causality in the first lag. The fact that there is a causality only in the first lag from CPI to GDP growth and GDP growth to oil prices shows that the variables are affected by the number of the lags. Therefore, the change in number of lags also affects the causality relationship. This relationship is shown graphically at Figure 17.

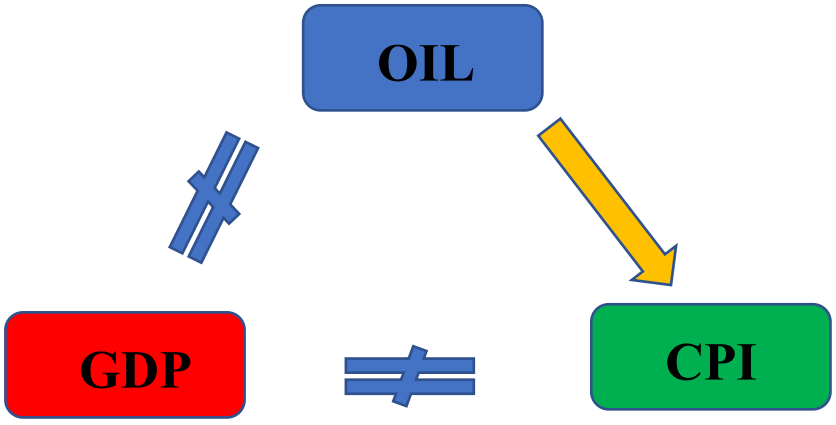


Figure 16: Granger Causality Cycle Between Variables

Figure 17 shows that there is one-way strong causality from oil prices to inflation, a weak one-way causality from inflation to growth and a weak causal relationship from growth to oil prices.

5. CONCLUSIONS

This study aims to examine the relationship between oil price shocks and economic growth on Turkey during the 2003-2018 period. Oil is one of the most important and non-renewable energy source and it is widely used in many areas. Because it is a natural resource it is difficult to replace. Regarding its importance, it has been subject to many research. In this study, the impact of oil price shocks on the economic growth is analysed during 2003-2018 and its effect on Turkey examined in detail. During 1973-95 period oil prices was significant impact on a Turkish economy as an oil importer country and 1973 oil shock deepened the economic problems in Turkey. During 1995-2001 period, Gulf Crisis effected Turkish economy severely. First half of 1990s economic instability was seen. During 2001-2008 period, oil price increases showed a continuous trend and it effected many sectors in Turkish economy. During 2008-2018 period, because of the effects of Global Crisis oil prices raised 100$ level in 2008, there was a decrease in production and increase in the prices of the goods and services. Moreover, its direct and indirect effects on economy was evaluated. Later, empirical analyses and its results shown by appliying eviews analysis.

Firstly, variables controlled for seasonal adjustment. New values of the series affected by seasonal variables included in analysis. GDP series were affected by seasonal changes and corrected. The first step in the empirical analysis involves testing of the unit root, Augmented Dickey-Fuller Test (ADF) and Philips-Perron (PP) unit root tests. All series are found I(1). Then, as a result of the cointegration analysis, it is seen that there is no long-term relationship between GDP, Oil and CPI, but these variables are affected by each other. While inflation affects growth negatively, and there is positive relationship between oil prices and development. In order to determine the effect of sudden changes on other variables, impulse-response analysis was performed. When impulse-response analysis results are evaluated in general, one unit of standard error shock (sudden change) in any variable causes a general reaction in other variables as well. Variance decompositions results in general; most of the changes in inflation stem from their own dynamics. Thereafter,

it stems from oil prices. The change in growth is mainly due to inflation. The change in oil prices is mostly affected by its internal dynamics. Then, it is affected by inflation. Consequently, Granger Causality test with different lags was applied to interpret causality among variables. When Granger Causality test results are examined; the change in the number of lags seems to affect the causality. In the 4^{th} delay, there is a causality relationship at 1% level towards the inflation in oil prices, while at the second and third lags, there is causality relationship at the level of 5%. In general, oil prices and the change in oil prices affect growth and inflation. The sudden change in oil prices affected inflation continuously, while it has a negative impact on growth. The change in inflation is caused from oil prices mostly and significant causality is found in oil prices to inflation. As a summary, there is one-way strong causality from oil prices to inflation, a weak one-way causality from inflation to growth and a weak causal relationship from growth to oil prices.

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