NEAR EAST UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
ECONOMICS PROGRAM

IMPACT OF OIL PRICE SHOCKS ON TURKEY'S ECONOMIC ACTIVITY

MUSTAFA HALGURD HAMADAMIN

MASTER THESIS

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2019

ACCEPTANCE APPROVAL

We as the jury members certify the 'Impact of oil price shocks on Turkey's economic activity' prepared by the Mustafa Halgurd Hamdamain defended on 21/01/2019 has been found satisfactory for the award of degree of Master

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I am master student, hereby declare that this dissertation entitled ‘ Impact of oil price shocks on Turkey’s economic activity’ has been prepared myself under the guidance and supervision of ‘Asst. Prof. Behiye Tüzel Çavuşoğlu’ in partial fulfilment of the Near East University, Graduate School of Social Sciences regulations and does not to the best of my knowledge breach and Law of Copyrights and has been tested for plagiarism and a copy of the result can be found in the Thesis.

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Dedicated with love to my entire family

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In the name of Allah, the beneficent, the most merciful. All praise is to Allah (SWT) who in his ultimate and bountiful mercy gave me the opportunity to study up to this level. May peace be upon our holy Prophet Muhammad (SAW), his companions, and those who follow his path until the Last Day.

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I wish to express my respect and appreciation to my parents Helgurd amin and Nergiz Mustafa and my entire family for their love, care and protection towards me and courage they have given me throughout my entire life. May Allah (SWT) reward you in abundance.

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ABSTRACT

IMPACT OF OIL PRICE SHOCKS ON TURKEY’S ECONOMIC ACTIVITY

This study aims at decomposing the impact of oil price shocks on the Turkish economy into its temporary and permanent components. It involves estimating an unrestricted VAR and using the methodology proposed by Blanchard and Quah (1989) to impose long run restriction. The econometric analysis employs monthy data on Turkish industrial production index and international oil price for the period spanning January 2000 to June, 2017. The annual growth rate of industrial production index is used to capture the growth of economic activitiy of Turkey, while the internatonal oil price (WTI) is employed to represent the oil price. The growth of economic activitiy of Turkey is found to be I(0) and the oil price is I(1). This indicates the suitability of using Blanchard and Quah decomposition. Impulse response shows that oil price shocks cause the Turkish growth of economic activitiy to rise for some months and then get back to equilibrium, but the response of oil price to Turkish growth of economic activitiy is zero. The impulse response also reveals that some oil price shocks affect the growth of Turkish economy permanently. In addition to this, variance decomposition shows that the source of shocks for Turkish growth of economic activitiy is largely from oil price shocks, while shocks coming from the growth of Turkish economy has little influence on the oil price shocks. The implication is that Turkish economy is not large enough to influence the world oil price, and that policies that address the impact of oil price shocks should take into consideration the transitory and permanent nature of the effect.

Keywords: Blanchard and Quah, impulse response, variance decomposition, Turkey, oil price, shocks.

ÖZ

PETROL FİYATLARI'NIN TÜRKİYE'DEKİ EKONOMİK FAALİYETLER ÜZERİNE ETKİSİ

Bu çalışma, petrol fiyat şoklarının Türkiye ekonomisi üzerindeki etkisinin geçici ve kalıcı bileşenlerine ayrıştırılmasını amaçlamaktadır. Sınırsız bir VAR'ın tahmin metodu ve Blanchard ve Quah (1989) tarafından önerilen metodoloji, uzun vade için kullanılacaktır. Ekonometrik analizde, Türkiye sanayi üretim endeksi ve Ocak 2000 ile Haziran 2017 arasındaki döneme ait uluslararası petrol fiyatlarına ilişkin aylık veriler kullanılmaktadır. Yıllık sanayi üretim endeksindeki büyüme hızı, Türkiye ekonomisinin büyüme değişkenini temsilen kullanılırken, uluslararası petrol fiyatları (WTI), petrol fiyatını temsil etmek için kullanılmıştır. Türkiye'nin ekonomik büyüme değişkeni I (0) ve petrol fiyatı değişkeni I (1) de durağan olarak bulundu. Bu, Blanchard ve Quah ayrıştırma tekniğini kullanmanın uygunluğunu gösterir. 'Impulse response' testine göre, petrol fiyatlarındaki şokların Türkiye'nin ekonomik büyümesinin birkaç ay yükselmesine ve ardından dengeye dönmesine neden olduğunu gösteriyor, ancak petrol fiyatlarının Türkiye ekonomik büyümesine tepkisinin sıfır olduğu anlaşılıyor. Bu test ayrıca, bazı petrol fiyatı şoklarının Türkiye ekonomisinin büyümesini kalıcı olarak etkilediğini de ortaya koyuyor. Buna ek olarak, varyans ayrışması, Türkiye'nin ekonomik büyümesine yönelik şokların kaynağının büyük ölçüde petrol fiyatlarındaki şoklardan kaynaklandığını gösterirken, Türkiye ekonomisinin büyümesinden kaynaklanan şokların petrol fiyatlarındaki şoklar üzerinde çok az etkisi olduğunu göstermektedir. Bunun anlamı, Türkiye ekonomisinin dünya petrol fiyatını etkileyecek kadar büyük olmaması ve petrol fiyat şoklarının etkisini ele alan politikaların etkisinin geçici ve kalıcı niteliğini göz önünde bulundurması gerektiğidir.

Anahtar Kelimeler: Blanchard ve Quah, impulse response, varyans ayrışması, Türkiye, petrol fiyatı, şoklar.

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CHAPTER 1

GENERAL INTRODUCTION

1.1 Introduction

The world economy has experienced several oil shocks since World War II. These oil shocks have been considered as major causes of recessions since almost all of them have been preceded by a dramatic increase in oil prices. For example, increases in oil prices preceded the recessions of 1973-75, 1980-1982, and 1990-91, and Hamilton (1983) presents evidence that increases in oil prices led declines in output before 1972 as well. These findings have led to discussion regarding the issue of whether the causes of economic downturns are primarily real or monetary. In this regard, some economists have raised doubt about the role of oil prices in the national economy, and also about the role of monetary policy since recessions over the past thirty years have also been preceded by a tightening of monetary policy. Hamilton (1983) was the first to investigate the effects of oil price shocks on macroeconomic variables with the VAR framework.

This thesis is aimed at investigating the impact of oil price shocks on the economic activity of Turkey

1.2 Statement of the Research Problem

A considerable number of studies have been devoted to examing the impact of oil price shocks on economic activity (see for example Hamilton, 2008). Oil price shocks are normally modelled as how the oil price shocks affect the aggregate level of economic activities of developed countries such as United

States (U.S). However, valuable insight can be obtained when focus is made to other economies like Turkey.

It is for this reason that examination of the effect of oil price shocks on economic activity is deemed important. So this study investigates how the shocks from changes in oil price affect economic activity in Turkey

1.3 Research Questions

The research questions for this study are listed as follows:

- How can we model and estimate the impact of oil price shocks on the Turkey’s economic activity?
- Do the oil price shocks have impact on the economic activity in Turkey?
- What are the policy implications of oil price shocks in formulating monetary or fiscal policies?

1.4 Aims and Objectives of the Study

The research centres on evaluating the impact of oil price shocks on Turkey’s economic activity. Other objectives include;

- To evolve an appropriate modelling technique in estimating the relationship between oil price shocks and economic activity in Turkey.
- To draw logically the policy implications of the oil price shocks and make meaningful recommendations.

1.5 Significance of the Study

This study seeks to explain how oil price shocks affect economic activity in Turkey. Moreover, the findings of this research work is expected to be of help to other student researchers who might be conduct research work in this area. Besides, it is also hoped that the research findings will be used by policy makers or analysts for sound policy implementation and policy analysis. Thus the outcome of this research work will be of tremendous importance to the citizens and government of Turkey.

1.6 Scope and Limitations of the Study

This study covers the period of January, 2000 to December, 2017. Two variables are used; industrial production index (IPI) and international crude oil price. The IPI is used as a measure of economic activity.

The limitations of the study are concerned with the period of study mentioned above. The conclusions and findings of this study are generalizable to Turkey as whole. The study does not examine the sector-specific effects of oil price shocks. In addition to these, there exists the problem of time constraint, which does not give room for in-depth research investigation about the study.

1.7 Organization of the Study

This research is divided into five chapters, each of them covering different aspect of the study. Chapter one deals with the general introduction of the research essay. The second chapter covers the theoretical framework and literature review of oil prices shocks on economic activity. Chapter three will be centred around in-depth information on the methodology. Chapter four will provide the empirical results. The last chapter consists of summary and conclusion of the study, policy recommendations, and further research areas.

CHAPTER 2

OVERVIEW OF THE TURKISH ECONOMY

2. Introduction

This chapter sheds light on the overview of the recent state of the Turkish economy. For this, sections are provided on the overview of the Turkish economic outlook and on the overview of the Turkish energy indicators.

2.1 Overview of the Turkish Economic Outlook

Turkish economic indicators in recent years indicate that the economy is almost getting down to its knees as the effects of the currency crisis keeps exacerbating. The Turkish Lira\dollar exchange rate got to all the time high within few months of the year 2018. In October, 2018, both consumer and producer confidence got extraordinarily low and marked fresh multi-year record lows. However, the pace of economic declined has slowed down around November of the same year. The sales of automotive sector sharply declined in the third quarter (Q3) of 2018, but industrial production and growth of retail sales markedly fell in August of the same year. Around November, 2018, the Turkish lira has begun to gain substantial strength, which is expected to reduce the burden of the external debt. The appreciation of Turkish Lira can be attributed to New Economic Plan which stipulated higher interest rate and tighter fiscal stance on the part of government after the Presidential election. Another factor that some economic consider as a reason for the appreciation of the Turkish Lira is the release of a U.S. pastor from the Turkish custody in the middle of October, action which lowered down the geopolitical tensions with the U.S.

The Turkish economy is expected to perform poorly next year, largely due to the restrictive financial conditions that can negatively affect private consumption and fixed investment. This nevertheless, the external sector is expected to provide some support that can counterbalance the negative effect of the restrictive financial conditions. On the hand, further uncertainty associated with the Lira/dollar exchange rate volatility in conjunction with the possibility of fresh geopolitical tensions may not augur well for the economy.

Figure 2.1 depicts the annual GDP growth in percentage from 2008 to 2017. Turkey experienced negative growth rate in 2008 and 2009. This coud be linked to the 2008 financial crisis, which had affected the economy till 2010. After the year 2010, Turkey has experienced sustained growth fluctuating around 4 percent to 10 percent.

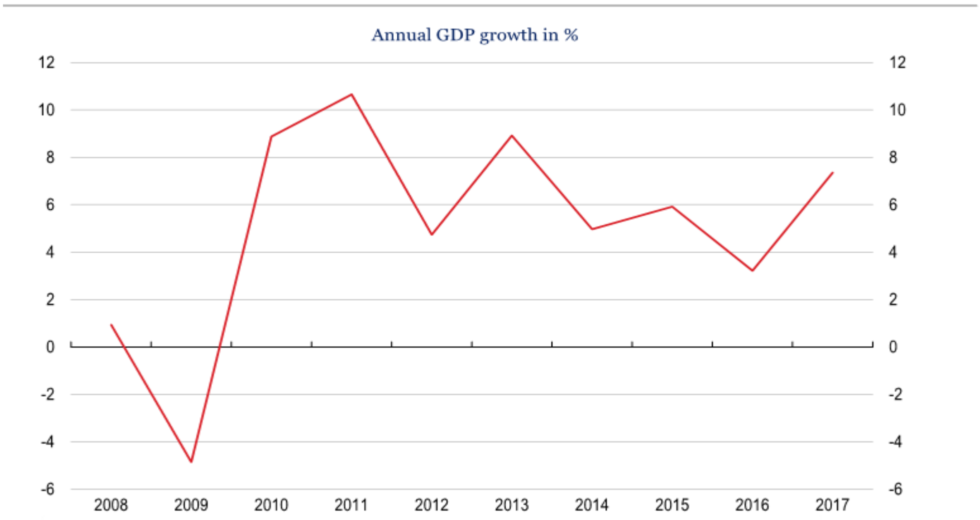

Figure 2.1: Annual GDP Growth in percentage (Source, OECD Economic Outlook)

Figure 2.2 represents total investment and total debt, percentage of GDP from 2010 to 2017. The left axis measure the total investment and the right axis measures the total debt. The rising trend for both the total investment and total debt is noticeable. In short, investment in Turkey is dynamic but increasingly funded by debt.

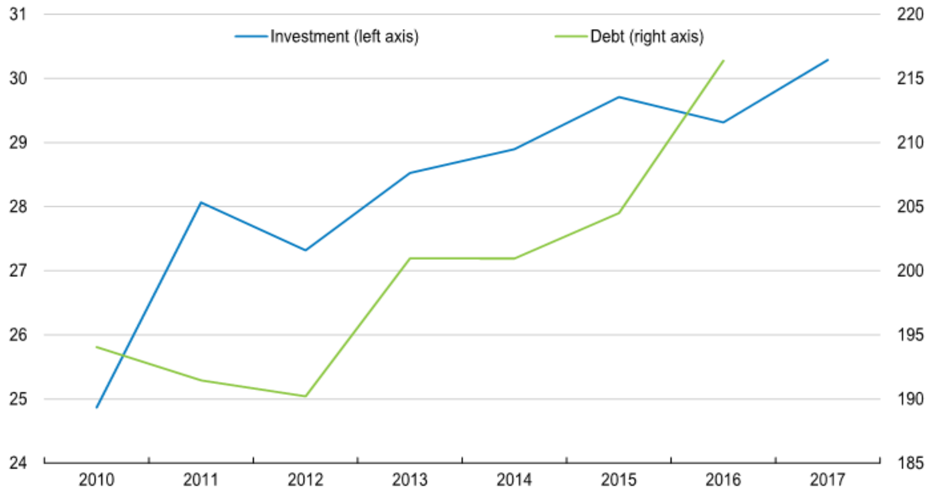

Figure 2.2: Total investment and total debt, percentage of GDP (Source: OECD)

Figure 2.3 is a graphical representation of the Turkey's current account balance, percentage of GDP, from 2002 to 2017. The highest current acount deficit was in 2011 and the lowest in 2002. The deficit of current account is rising in recent years of 3025, 2016 and 2017.

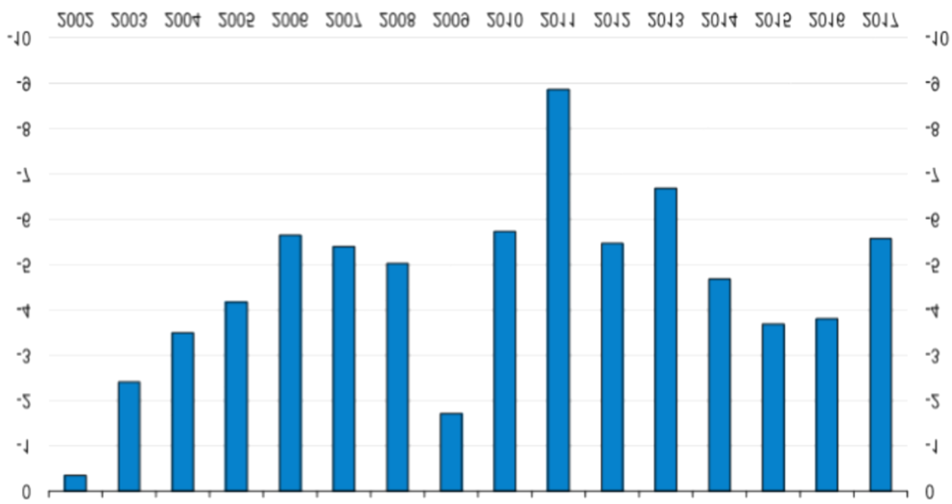

Figure 2.3: Current account balance, percentage of GDP (Source: OECD)

Figure 2.4 shows the inflation expectations and inflation target, year on year percentage changes of Turkey from 2006 to 2018. Since 2010, both 12-month ahead and 24-ahead inflation rates have been higher than the inflation target. In other words, inflation is rising sharply

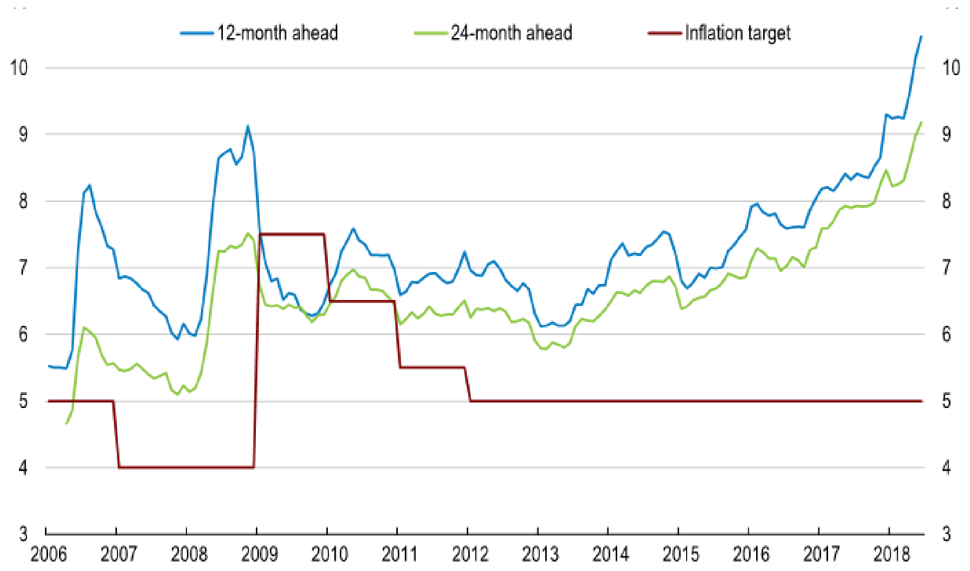

Figure 2.4: Inflation expectations and inflation target, year on year percentage changes (souce: Central Bank of Turkey)

Figure 2.5 provides the movement of the Turkey, real exchange rate with 2010 as the base year from the first quarter of 2005 to the first qurter of 2018. Since the third quarter of 2008, a downward trend is observable. This could be linked to policy option to devalue the Turkish lira in order to address the 2008 financial crisis. From the figure, it is obvious that the Turkish lira has depreciated significantly.

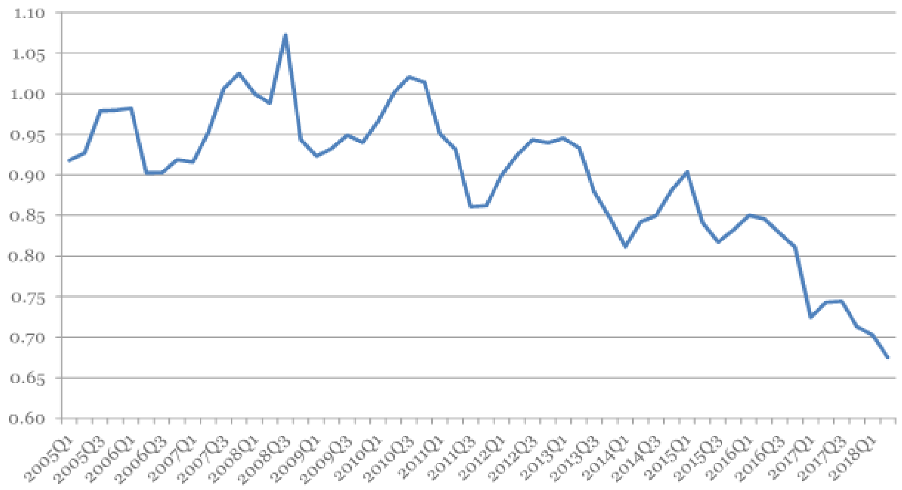

Figure 2.5: Real exchange rate (2010=1) (source: OECD)

2.2 Overview of the Turkish Energy Indicators

This sections attempts to the Turkish outlook from the energy point of view. Some indicators such as Oil rents (% of GDP) (OIR), GDP per unit of energy use (PPP $ per kg of oil equivalent) (GEP), Alternative and nuclear energy (% of total energy use) (ANE), Energy imports, net (% of energy use) (EIN), Fossil fuel energy consumption (% of total) (FFC) and Renewable energy consumption (% of total final energy consumption) (REC). Table 2.1reports the time series of these indicators for the period of 2000 to 2015. The data set for 2016 and 2017 is not available on the Worldbank Database.

Table 2.1: The Energy Indicators

YEAR	OIR	GEP	ANE	EIN	FFC	REC
2000	0.112322	7.977988	4.744586	65.95818	86.30128	17.26661
2001	0.103553	8.428926	4.444041	65.23943	86.12402	18.11179
2002	0.090544	8.188701	5.440818	67.51048	86.08868	17.45918
2003	0.080532	8.149509	5.461543	69.71013	87.0572	16.27997
2004	0.079924	9.018221	6.483342	70.13259	86.70592	16.77239
2005	0.100348	9.585709	5.698574	71.58227	88.05964	15.2981
2006	0.105027	10.05549	5.578739	71.71294	89.00397	14.24549
2007	0.088362	10.3306	4.58112	72.7255	90.49675	12.4846
2008	0.109427	11.45248	4.563276	70.64201	90.57388	12.4155
2009	0.075365	11.29513	5.392985	69.03588	89.89939	13.32838
2010	0.096065	11.82832	6.659472	69.62477	89.12864	14.3265
2011	0.129038	12.71559	6.692657	71.60758	90.01236	12.78061

2012	0.114957	13.01871	7.176466	74.01712	89.47822	12.83168
2013	0.100794	14.45949	7.954758	73.06536	88.23206	13.84755
2014	0.093162	15.22963	7.120458	74.20811	89.57631	11.60789
2015	0.041932	14.99568	9.605489	75.20788	87.59121	13.37423

Abbreviations: Oil rents (% of GDP) (OIR), GDP per unit of energy use (PPP $ per kg of oil equivalent) (GEP), Alternative and nuclear energy (% of total energy use) (ANE), Energy imports, net (% of energy use) (EIN), Fossil fuel energy consumption (% of total) (FFC) and Renewable energy consumption (% of total final energy consumption) (REC).
Source: World Bank's World Development Indicators database.

The movement of Oil rents (% of GDP) (OIR) is depicted in **Figure 2.6**. Oil rents are the difference between the value of crude oil production at regional prices and total costs of production. The series is the estimates based on sources and methods described in "The Changing Wealth of Nations 2018: Building a Sustainable Future" (Lange et al 2018). As shown in the figure, the highest OIR (0.129) is observed in the year 2011 and the lowest (0.042) is recorded in the year 2015.

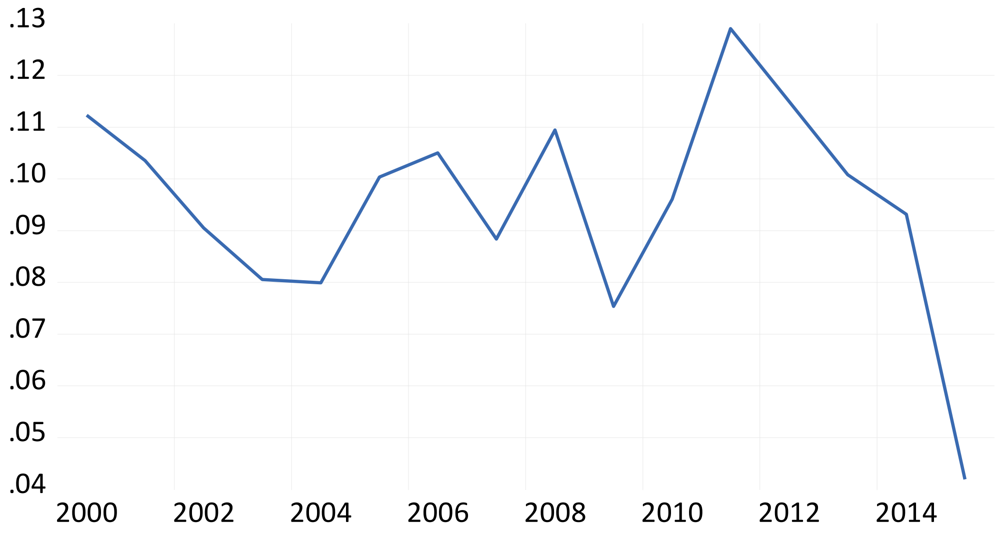

Figure 2.6: Oil rents (% of GDP) (OIR)

Figure 2.7 depicts the graph of GDP per unit of energy use (PPP $ per kg of oil equivalent) (GEP) (OECD, 2018). GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to current international dollars using purchasing power parity rates based on the 2011 ICP round. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States. Higher GEP signifies better efficiency in the use of energy. It is seen that the efficiency of energy consumption is increasing every year, with the peak of 15.2 recorded in 2014.

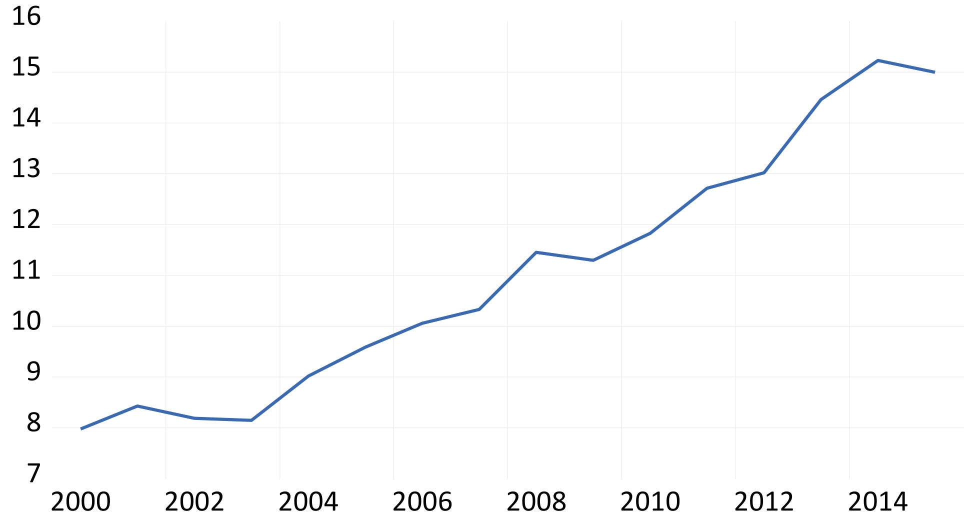

Figure 2.7: GDP per unit of energy use (PPP $ per kg of oil equivalent) (GEP)

Alternative and nuclear energy (% of total energy use) (ANE) measures the percentage of energy used other than the fossil fuel energy. Higher percentage indicates lower pressure on the of fossil fuel energy. By definition, ANE implies clean energy which is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others. According to **Figure 2.8**, ANE follows an upward trend indicating that Turkey improves the use of alternative sources in order to reduce the pressure on the fossil fuel. However this effort was undermined the 2008 financial crisis as indicated the trough around 2008 in the figure.

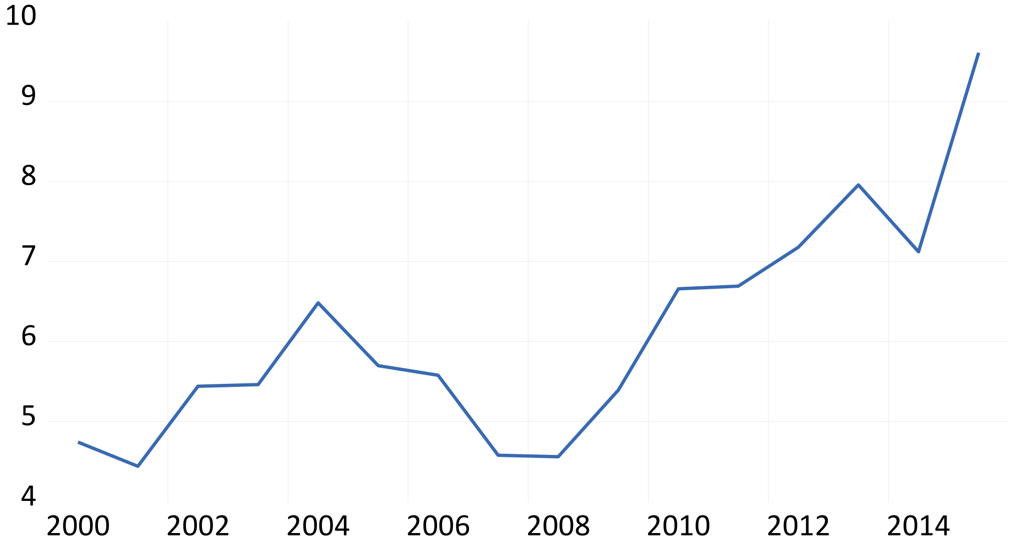

Figure 2.8: Alternative and nuclear energy (% of total energy use) (ANE)

Energy imports, net (% of energy use) (EIN) is represented by **Figure 2.9**. Net energy imports are estimated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport. As shown in the figure, Turkey imports about 75 per cent of the energy is uses. Therefore it is safe to describe Turkey as an oil-importing country.

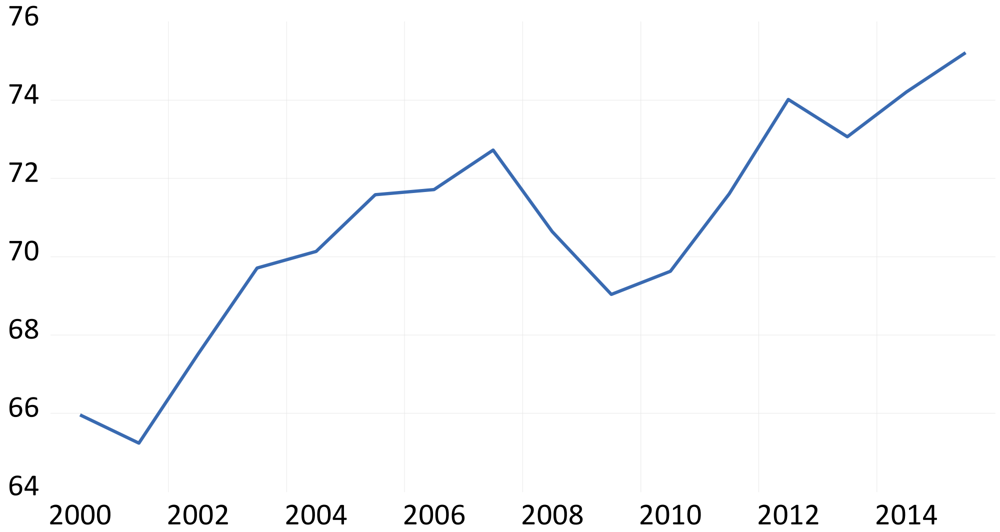

Figure 2.9: Energy imports, net (% of energy use) (EIN)

Fossil fuel comprises coal, oil, petroleum, and natural gas products. Fossil fuel energy consumption (% of total) (FFC) is graphically represented in **Figure 2.10**. The figure shows that FFC constitute the largest chunk of the total energy consumption in Turkey. The FFC seems to have an increasing trend before the 2008 financial crisis, but decreasing trend afterwards. This implies the increased consumption ANE after the financial crisis. In this sense, 2008 financial crisis is like blessing in disguise for the Turkish energy sector.

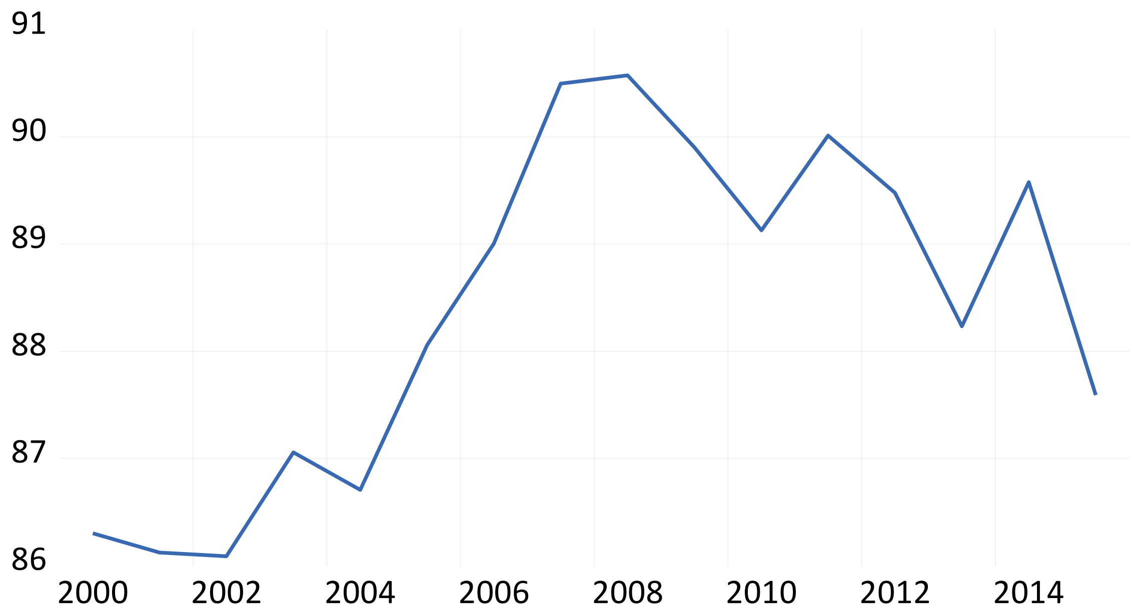

Figure 2.10: Fossil fuel energy consumption (% of total) (FFC)

The last energy indicator considered in this study is renewable energy consumption (% of total final energy consumption) (REC). With help of **Figure 2.11**, it is possible to represent this indicator in a compact graph. Renewable energy consumption is the share of renewable energy in total final energy consumption. The figure indicate the continuous fall in the share of use of renewable energy over the years.

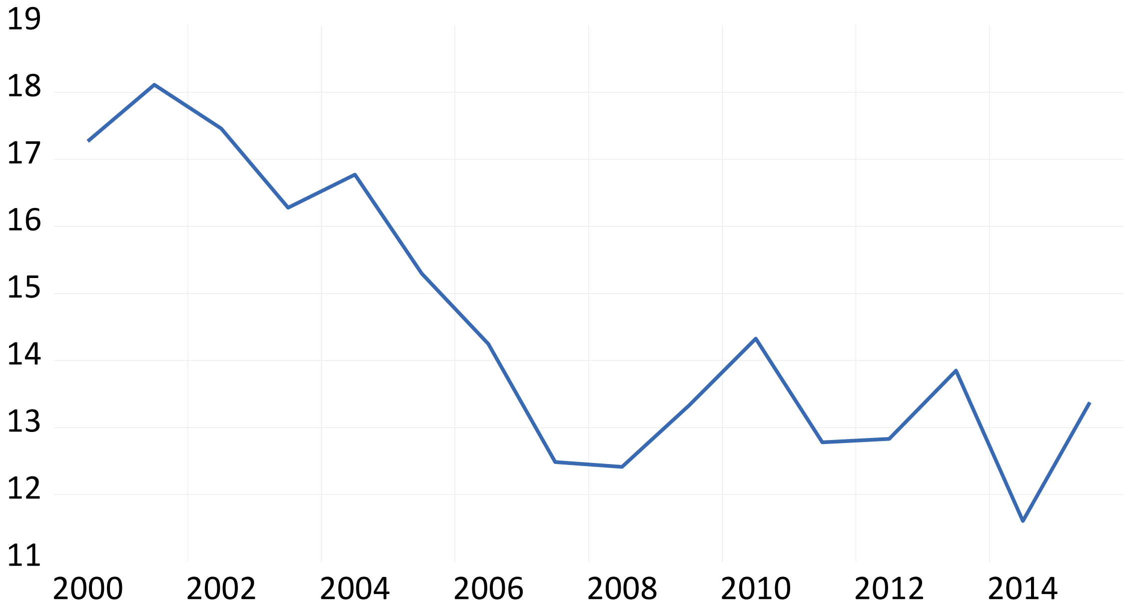

Figure 2.11: Renewable Energy Consumption (% Of Total Final Energy Consumption) (Rec)

2.3 Summary

This chapter provides an overview of the Turkey's economy in general and its energy sector. In short, the above observation regarding the energy indicators in Turkey reveal that Turkey is an oil-importing country and that it relies on fossil fuel for its energy sector of the economy.

CHAPTER 3

LITERATURE REVIEW

3. Introduction

This section discusses both the theoretical and empirical literature review. The theoretical literature covers the textbook explanation about the interrelationship between economic activity and oil price, while the empirical literature discusses the findings of other studies in the area.

3.1 Determinants of oil price

Liu (2010) identifies factors that influence oil price can be roughly categorised into three major categories. These factors include macroeconomic fundamentals, supply related factors and others.

3.1.1 Macroeconomic fundamentals

Studies on the relationship between macroeconomic variables and oil price are quite large. These studies consider the exogeinity of oil price changes to the economy and pay attention specifically on the effects of oil price shocks on the macroeconomy and how these shocks are transmitted (See Hamilton, 1996; Blanchard and Galí, 2007; Park and Ratti, 2008). These studies contain a review of theoretical and empirical developments of the oil-price-macroeconomic relationship since 1996.

In contrast to the above studies, many studies contend that global GDP is the main factor of oil price (Baldwin and Prosser, 1988; Dahl and Yucel, 1990; Bacon, 1991; Kilian and Murphy, 2012; Hamilton 2008). Krichene (2007) argues that changes in the rate of world growth of economic activitiy may result in significant changes in oil demand, and this eventually results in downturns or upturns in oil prices. Kilian (2008) takes the oil price as endogenous and establishes causality of the U.S economy and global real economic activity to the price of oil. In addition to this, some studies establish that other determinants of oil price such as interest rate (Dahl and Yucel, 1990; Kilian and Murphy, 2012; Krichene, 2007) and monetary policy (Frankel, 2006) and exchange rate (Baldwin and Prosser, 1988; Dees et al., 2007)

3.1.2 Supply-side factors

Since oil is a standard good, any determinants of its supply is also a factor that can affect its price. Hence, a large number of studies pay attention to the supply-related factors of the oil market. Some of the supply-related factors pointed out in various studies include

Oil exploration costs, oil extraction / production costs (Dahl and Yucel, 1990; Bacon, 1991; Dees et al. 2007) and oil transportation costs (very large crude carrier rates; see Brook et al., 2004; Möbert, 2007). Dahl and Yucel (1990) and Bacon (1991) focus on oil exploration costs, Dees et al. (2007) considers oil extraction/production costs, while Brook et al., (2004) and Möbert (2007) take into account the oil transportation costs. For the sake of evaluating the effect of field production on oil price, Lynch (2002), Möbert (2007), and Hamilton (2008) use the number of active oil rigs as explanatory variable, Dahl and Yucel (1990) employ the number of wells drilled as the main factor. Brook et al. (2004) also employ the number of active oil rigs to serve as a representative of the active exploration and development activities. Some influential factors are geographical in nature, as Lynch (2002) emphasises that oil production is determined not only by discovery, but it is also determined by the amount of capacity lost as a result of depletion effects. Dwindling production from the mature Chinese fields partly explain the recent course of world oil prices, as argued by Hamilton (2008). In order to model the global crude oil market, some studies consider both proven crude oil reserve and additions to the reserve as explanatory variables (Baldwin and Prosser, 1988;

Dahl and Yucel, 1990). Krichene (2007) studies oil price using a simultaneous equations model. He establishes a positive correlation between proven reserve and oil output, but negative correlation between proven reserve and oil prices. In addition to this, Brook et al. (2004) also supports the importance of strategic petroleum reserve (SPR) in modelling oil price. Their argument is that SPR, through its effect on market psychology, has the capacity to affect oil markets. However, it is not easy to quantitatively study the role of SPRs, because, as Chevillon and Rifflart (2009) contend, governments are unwilling to report them. Probabilistic estimates suggest that undiscovered reserves, when combined with growth of existing reserves, could lead to doubling the current proven reserves. Unfortunately, new discovery of oil reserve tend to be smaller and more expensive to develop as a result of huge costs of exploration, development and production. Hence, more investments in the global oil sector are necessary for expanding supply capacity, promoting technological progress, and replacing existing and future supply facilities. Brook et al. (2004) and Elekdag et al. (2007) argue that low increase of additional capacity and low excess capacity are due to the insufficient and lagging investment in the oil sector. It is noticeable that the oil supply has recently become noticeably rigid and therefore excessively susceptible to even slight disruptions. Consequently, the oil price is more sensitive and higher than before.

In addition to the above factors, another issue that attracts the attention of the researchers in this area is the microstructure of the oil market. Researchers focus heavily on the interaction of OPEC and Non-OPEC behaviour in determining supply and pricing behaviour. Dees et al. (2007) model the global oil demand and supply with a price rule equation, which makes some factors as explanatory variables such as OPEC production quota, the difference between this production and OPEC quota as well as OPEC production capacity utilization. Some studies discuss the role non-OPEC countries play in oil market competition (Baldwin and Prosser, 1988; Dahl and Yucel, 1990; Dees et al., 2007). Dees et al. (2007) analyses production capacity as a collection of certain factors such as OPEC or Non-OPEC total production capacity, Elekdag et al. (2007) discuss OPEC spare capacity, Bacon (1991) and Lynch (2002) consider OPEC or Non-OPEC capacity addition, Baldwin and Prosser (1988), Lynch (2002) and Möbert (2007) include OPEC or Non-OPEC capacity utilization in their models. Dees et al. (2008) contend that the sensitivity of oil prices to supply increases as oil production approaches full capacity. Consequently, they study the non-linearity of impact of OPEC capacity utilization and establish the non-linearity of relationships between OPEC spare capacity and oil prices. Moreover, Dees et al. (2008) link the cause of oil price increase to the lack of spare refining capacity, as they employ refinery utilization rates as exogenous variable in their model. Their findings also indicate that the refining sector is also an important factor that plays a role in the determination of oil price. The relationship they establish is that the higher refinery utilization rates, the lower the oil prices. Möbert (2007) studies the impact of refinery capacity utilization rate on oil price and establishes that the latter rises if the former is above 97% but the magnitude decreases as free refinery capacity further decreases.

Pindyck (2001) categorises inventory as another important factor of oil price and conducts theoretical analysis on its on oil price determination. Ye et al. (2005) conducts oil price analysis using a short-term forecasting model which includes monthly West Texas oil spot price along with levels of OECD oil inventory. In order to examine the impact of inventory on oil price level, Brook et al. (2004) include as exogenous variables the OECD inventory and the difference between actual and desired level of inventories. Chevillon and Rifflart (2009) use the number of days of forward cover provided by OECD industry stocks as a proxy of inventory.

Since global political, economic, geological and natural conditions affect oil production, some researchers use dummy variables for the sake of capturing such exogenous shocks to oil price (Dees et al., 2007; Möbert, 2007). Dees et al. (2007) uses dummy variables to capture the Mexico Peso crisis, Persian Gulf War and other institutional and geological factors determining oil production. On the other hand, Möbert (2007) captures negative and positive events with different dummy variables. In order to capture positive supply-related events such as U.S. SPR release and also supply-related negative events such as hurricane Katrina and Rita.

3.1.3 Other factors

Besides above two categories of determinants of oil price, there exists another class of variables that also determines oil price but do not fit in conveniently into either of the above categories. Most of them are likely to affect both the demand and supply of crude oil. One of these variables is price volatility. Pindyck (2004) and Brook et al. (2004) among others examine the effect of price volatility on oil price. The idea of their argument is that volatility influences the level of oil prices in two different ways. Firstly, high price volatility could induce refiners and consumers to keep higher level of inventories, which, other things being equal, pushes prices up in the short run. Secondly, high volatility could lead to raising the value of the call option of the oil producers. The result of this is increasing the opportunity cost of current production, which may ultimately lead to decrease in oil supply. The interaction of higher demand for inventories and reduction in oil supply will ultimately lead higher oil prices. Although the effect as a result of the first channel is likely to be temporary, the effect as a result of the second channel tend to be persistent as long as the high volatility is persistent. Moreover, if price volatility is compounded by geopolitical instabilities, uncertainty about underlying price trends is likely to rise and consequently causes decrease in oil exploration. This will make growth of global energy demand faster than the growth oil production capacity, with consequences of low excess capacity and rise in oil price.

Another important factor that has the capacity to determine oil demand and supply is the technological progress. On the demand side, technology advances serve as a contributing factor in efficient oil consumption, lead to discovery of oil substitutes and gradual shift from the demand for oil to other alternative sources (Brook et al., 2004). From the supply-side perspective, Lynch (2002) provides the view that technological progress enhances the success rate of exploration, leads to improvement in drilling and extraction productivities and hence increases the global recovery rate. In general, technology advances have dual role of reducing the dependence on oil as a source of energy and at the same time increasing oil supply, leading to downward pressure on oil prices.

Another determinant of oil price is substitutability. The price and production of other substitute of oil have the potential of affecting both the supply of and the demand for oil. Krichene (2005) and Dees et al. (2007) investigate how natural gas, either its price or production, affects oil price.

Considering other alternative energy than natural gas, Bacon (1991) also evaluates the effect of coal and nuclear power on oil price. Population growth and seasonality are two other possible factors that are considered in oil price shocks literature. Since some portion of crude oil is used in the production of heating oil, then the weather changes may be partially responsible for influencing demand for and price of oil. For this reason, Ye et al. (2002) and Dees et al. (2007) include seasonality in specifying oil price models. Möbert (2007) classify months into spring and summer and use different variables to represent the two period. His findings reveal that in the demand for oil is smaller in the months of March, April, and May than the rest of the year and that the oil price increases in the summer months more commonly. The outcome can be explained partly by the fact that, during summer vacation, consumers tend to drive more. In addition to this, population is also an important demand variable. Population is not directly modelled as it is contained in the GDP per capita. Krichene (2007) mentions it but does not include it in his model.

3.2 Previous Studies

The impact of oil price shocks on macroeconomic variables ignite great interest among researchers and therefore studies have been conducted assess the impact of oil price shocks on the production cost, stock market, inflation expectation, economic activity, monetary policy and investor confidence (Hamilton 1983; Mork 1989; Hooker 1996; Cologni et al. 2008).

Some studies establish the existence of a significant nonlinear correlation between the oil price shocks and some macroeconomic variables (Shapiro and Watson, 1988; Mork, 1989; Mory, 1993; Ferderer, 1996; Hamilton 2003; Kilian and Murphy, 2012; Lardic and Mignon 2006; Wen et al. 2017).

Hamilton (1983, 1993) provided the evidence that between 1948 and 1972, the United States (U.S) recessions could be partly explained by the oil shocks. About seven cases of recessions in the U.S that occurred after the Second World War (WWII) witnessed a high increase in the oil price. Thus he established a negative correlation between oil price shocks and economic activity. This finding is not a coincidence, because the timing and duration of the recessions might not be the same if the oil price had not increased. It is obvious that neither of the two approaches, demand-side and supply-side economics, could explain this outcome. However a combination of the two approaches could be utilised to explain the phenomenon.

Shapiro and Watson (1988) employed quarterly U.S. data on total hours worked, output, inflation, nominal interest rate, and real oil from 1951 to 1985 to estimate an AD-AS model. They contend that oil price shocks are an important factor in causing the recessions that came with OPEC crises. This finding led to the curiosity about the possible asymmetry of oil price effect on output.

Mork (1989) consider price control of 1970 in his model and find weaker results than Hamilton's. He employed the data covering 1949:1 to 1971:2 the price control led to weaker effect of oil price on real output. The findings further indicate an asymmetric effect of oil prices on output.

Mory (1993) regress output on lagged oil prices using the sample period of 1951 to 1990, with an aim of testing the hypothesis of a possible asymmetry of relationship between oil price and economic activity. Mory first estimated a model without considering negative and positive changes in oil price and find an elasticity of 0.055. He then decomposed the oil price, considering negative and positive changes, and re-estimated the model. The findings reveal an elasticity of -0.107 due to positive oil price changes and insignificant elasticity of 0.00163 following negative changes in price. This attests to the asymmetric nature of relationship between the oil price and real economic activity.

The common feature of the studies above is that they employ data at national levels. Some studies are conducted at regional level (Brown and Yucel, 1995; Iledare and Olatubi, 2004; Penn, 2006; Engemann et al., 2011). According to Engemann et al. (2011), the impact of oil price shocks on economic activities differ from one state to another and can vary from its impact on the economic activity of the country as a whole. Brown and Yucel (1995) find that movement in energy prices led to the differences in regional economic performance. Positive changes in oil prices is responsible for stimulating economic growth in oil producing regions and responsible for causing slowdown in economic growth in regions that import oil. Penn (2006) reveal that some states in the U.S show greater sensitivity to oil price changes than others. Iledare and Olatubi (2004) contend that changes in oil price directly affect economic performance of Gulf States and that the impact differs from one state to another.

Although the role of oil price shocks has been discussed in different settings, Jo (2014) takes a different turn by looking at the impact of oil price shocks on global real economic activity and offers a new framework that enables researchers to investigate the dynamic responses of global real economic activity to an oil price shock. He further points to the importance of modeling the impact of oil price shocks that do not evolve mainly in relation to the irreversible decision-making process such as firm-level investment or durable goods consumption (see for example Bernanke, 1983; Pindyck, 1991). These studies show that firms delay irreversible investment decisions until more information is gathered, especially when the cash flow from the investment is determined by the oil price (Jo, 2014). The same conclusion is arrived at for the consumption of durable goods, as the decision to purchase vehicle is irreversible (Jo, 2014; Kilian and Vigfusson, 2011). As Jo (2014) noted, cyclical fluctuations in the economy can occur as a result of delay for decision about irreversible expenditures on investment and consumption of durable goods. In addition, Edelstein and Kilian (2009) show that increased oil price leads to igniting uncertainty among consumers and in turn affect their expenditures negatively, thereby leading to increase in precautionary savings. Plante and Traum (2012) employed

Dynamic stochastic general equilibrium (DSGE) framework to investigate the role of oil price shocks. Their findings reveal that increased oil price shocks in general equilibrium model may lead to rise in investment and increase in real GDP. The rise in investment and real GDP is attributable to the rise in the precautionary savings motives. Another study is conducted by Alquist, Kilian, and Vigfusson (2013) show that it is not easy by construction to link the enormous fluctuations in real economic activity to oil price shocks. Moreover, they contend that commonly used measure of oil price shocks does not capture the oil price shocks well.

Lee, Ni, and Ratti (1995) pioneered the emphasis on the importance of considering the variance of oil prices in forecasting economic activity. They proposed a new measure of oil price shocks, which affect not only the size but also the variability of the forecast error. They further argue that this new measure explains changes in GNP better than real oil price changes. The implication of this is that the effect of an oil price change of a certain size can be different depending on whether the event is an unusual or new.

Ferderer (1996) finds that oil price volatility can be helpful in forecasting the growth of industrial production of the U.S economy. The underlying assumption of the study is that oil price is exogenous to the U.S economy.

Studies on oil price shocks also try to answers some questions pertaining to asymmetry of the effect of oil price shocks. The idea is that uncertainty attached with changes in oil price is presumed to affect real economic activity negatively regardless of the direction of the price change. The uncertainty causes amplification of the recessionary effects of positive oil price shocks, in contrast to negative oil price shocks in which case the uncertainty leads to dampening of the expansionary process. Hence, some studies examine the role of uncertainty through testing whether response functions to negative and positive price shocks are symmetric (Kilian and Vigfusson, 2011; Herrera, Lagalo, and Wada, 2012; Herrera and Karaki, 2012).

The unanimous agreement among studies in the oil price shocks literature is that there is no compelling evidence to support the asymmetry of responses of economic activity at the aggregate level in the U.S. or in other developed economies, whereas some studies find mixed evidence for the disaggregate level.

Kellogg (2010) studies the effect of oil price shocks at state level. He establishes the support of an uncertainty effect for oil production in Texas, however tests for asymmetry of responses of industrial production indicate limited asymmetries. Another alternative approach that is prevalent in the literature involves designing a model that captures the role of oil price uncertainty, and simultaneously exploring all other potential sources of asymmetry of responses. Some studies extract the impact of oil price uncertainty from the vector autoregressive (VAR) model (Bredin, Elder, and Fountas, 2011; Elder and Serletis, 2010). The last two studies employ generalized autoregressive conditional heteroscedasticity (GARCH) process to measure price uncertainty; to be specific, they both employ a two-variable GARCH-in-Mean VAR which includes economic activity and oil price for the U.S. and G-7countries respectively. The novelty of their studies is relaxing the assumption of exogeneity of oil prices and replacing it by the weaker assumption whereby oil price and its uncertainty are assumed to be predetermined (see Kilian and Vega, 2011).The outcome of their studies reveal that a rise in oil price uncertainty affects real economic activity negatively. Their conclusion is that the oil price surge in the 2003–08 period has been rather persistent and continuous, the feature that helps keep oil price uncertainty at the lower rung of the ladder. Hence, unlike the previous instance of oil price instability, the 2003-08 oil price episode is less disruptive as it did not cause an instant economic recession. Elder and Serletis (2011) and Rahman and Serletis (2012) succeeded in applying a similar model in different countries.

There is not one primary energy market and the price of oil is not a good proxy for many alternative energy prices. Melichar (2016) explores the literature about the choice of energy price to be used as a representative of oil price for a period from July 1979 to June 2011. He therefore explores how alternative energy price shocks affect economic activity. He further assesses the relative performance of these competing oil price measures in forecasting the state-level economic activity with the help of Davidson-MacKinnon J-test. He takes into account the prices of natural gas, heating oil gasoline, diesel, and electricity as alternative energy prices. These alternative measures of energy price shocks led to the emergence of various shapes and patterns of impulse responses that are different from the shapes and patterns of the impulse responses produced by the oil price shocks. in addition to this, further evidence shows that models with alternative energy price have better forecast performance when compared with the baseline model which includes oil prices at both short, mid and long horizons. He finally arguers that models with alternative energy prices provide a better and more accurate avenue to model the macroeconomy-energy-price relationship.

Jo (2014) investigates how oil price uncertainty affects the global real economic activity. The econometric methodology employed is vector autoregressive model (VECM) with stochastic volatility in mean with the sample size spanning 1958Q2 to 2008Q3. The estimation results indicate that an oil price uncertainty shock has negatively affected global real economic activity, other things being equal. The study has shown that doubling volatility of oil price can be connected with cumulative fall in global real economic activity as high as 0.3 percentage points.

Hu et al. (2017) studies the asymmetric impact of oil price shocks on the China's stock market using a sample span of August 2004 to August 2016. The study is conducted based on integration of the structural vector autoregressive (SVAR) model and nonlinear Autoregressive Distributed Lag (NARDL) model in order to investigate the short-run and long-run asymmetric effect of structural shocks of oil price on the China's stock market. They find that, the demand-side shocks of oil price significantly affect the China's stock market in both long run and short run, but the supply shock shows otherwise. As for the asymmetric relationship, they cannot establish any evidence that supply shock and the oil-specific demand shock have asymmetric impact on the Chinese stock market, but that the aggregate demand shock affects the stock market asymmetrically in the short run only.

Herrera, Lagalo and Wada (2014) also study the asymmetries in the responses of economic activity to changes in oil price of some members of Organization for Economic Cooperation and Development (OECD). They have attempted to disprove the common belief that the relationship between economic activity and increase or decrease in oil prices is asymmetric. Herrera, Lagalo and Wada (2014) argues that the studies that establish the asymmetry rely on the theoretical underpinnings such as costly sectoral reallocation and partial equilibrium models. The partial equilibrium model here refers to the model of irreversible investment and precautionary savings. However, recent studies have cast doubt after using U.S data along with new methodologies for testing for. The study use the state-of-the-art econometric methodologies to investigate the presence of asymmetries for some members of the OECD which are a blend of oil importers and oil exporters. They establish very insignificant support for the hypothesis that industrial production respond asymmetrically to oil price increases and decreases. The significant implication of their results for theoretical models is that they indicate the relevance of direct-demand and direct-supply in the transmission of shocks, as well as avenues for indirect transmission of shocks that imply a symmetric response.

Shetty, Iqbal and Alshamali (2013) examine how economic activity responds energy price shocks in Texas Cities over the period of 1995 to 2008. The study is conducted to find out how exogenous shocks in energy price can affect city economies as it examines unemployment rates in Texas cities vis a vis oil price movements by employing granger causality, impulse response and variance decomposition. Their findings reveal that unemployment in the larger cities does not significantly respond to oil price changes, while unemployment in the small cites especially the border ones respond significantly to the changes in oil price. Their findings further reveal that Texas economy is not susceptible to oil price changes because it has become more diversified in the last two decades and that the smaller border economies are still vulnerable to oil price shocks via the neighboring country Mexico. The data used in their study indicate significant fluctuations in the unemployment rate in small cities following changes in oil price. Additionally, improvements in unemployment of the small cities are observed after oil price has increased.

Babajide and Soile (2014) analyses the effect of oil price shocks on Nigeria's economic activity over the sample period of first quarter of 1980 to the fourth quarter of 2011. The study employs ARDL bounds test and Vector Error Correction Model for the data analysis and examines how oil price shocks and their transmission mechanisms affect some macroeconomic indicators that represent economic activities in Nigeria. The outcome of the study shows that oil price shocks have negative effect on almost all the proxies of economic activity used in the analysis. Additionally the symmetry of relationship between oil price shocks and GDP was not supported. The findings also show that oil price decreases affect more macroeconomic indicators than oil price increases do. The study finally recommends that government should not intervene through monetary policy during an era of oil price variations.

Aydın and Acar (2011) investigates the economic impact of oil price shocks on the Turkish economy. The study employs dynamic Computable General Equilibrium (CGE) analysis on Turkey's 2004 input-output table. The variables they employ to represent the economic activity include GDP, consumer price inflation, indirect tax revenues, trade balance, and carbon emissions. For the analysis of the potential long-term impact of oil price shocks on macroeconomic variables of interest, they developed a dynamic multisectoral general equilibrium model for the Turkish economy (TurGEM-D). Their simulation results reveal that high and low oil prices have very significant effects on the Turkey's macro indicators and carbon emissions.

Doğan, Ustaoğlu and Demez (2012) examine the relationship between real oil price and real exchange rate in Turkey over the sample ranging from February, 2001, to July, 2011. They argue that for the non-oil-exporting developing countries like Turkey, which lack sufficient amount of oil and energy resources, real exchange rate and real oil prices are important for sustainable economic growth rate and that real oil price is affected by the fluctuations in the real exchange rate which require changes to the macro-economic policies. Using cointegration with structural breaks tests by Perron veKejriwal (2009), they find that increase in real oil price causes decline in Turkish real exchange rate.

Katircioglu, Katircioglu and Altun (2018) examine the moderating role of oil price changes in the effects of service trade and tourism on growt in Turkey. They use error correction model (ECM) on timeseries of GDP, gross capital formation, labor, foreign trade volume, trade in services, tourism, real exchange rates, and oil prices from 1960 to 2017. The results of this study confirm that oil prices negatively impact on real income growth of Turkey.

Rasasi and Yilmaz (2016) examine the effects of oil shocks on Turkish macroeconomic aggregates over the sample of 1987:Q1 to 2015:Q2. Employing structural vector error correction (SVEC) model, the study finds that oil price shocks affect output growth negatively with a delay. In addition to that, the impulse response analysis indicates that GDP growth responds positively to oil price shocks.

Gökçe (2013) investigate the dynamic impacts of oil price shocks on Turkey's economic growth using timeseries data from 1987:Q1 to 2011:Q4. The study employs exponential GARCH(p,q) to model oil price volatility and then estiamate the dynamic structural relationships between oil price volatility and economic growth with the help of structural VAR model. The findings suggest that the long-run response of accumulated economic growth to a structural shock in real crude oil price volatility is negative.

Ozturk (2015) conducts a study on oil price shocks-macro economy relationship in Turkey with a sample from 1990Q1 to 2011Q4. Vector Autoregression (VAR) models and bivariate show that both symmetric and positive oil price shocks decrease industrial production, money supply, and imports while the negative oil price shocks increase imports.

3.3 Summary of the Recent Literature

This section provides a brief summary of the most recent studies in tabular form. The table will present the extract of the author(s), sample, country and findings of the studies.

Table 3.1: Summary of the Recent Literature

Study	Sample	Methodology	Country	result
Babajide and Soile (2014)	1980 to the fourth quarter of 2011	ARDL bounds test and Vector Error Correction Model	Nigeria	oil price shocks have negative effect economic activity, asymmetry not supported
Shetty, Iqbal and Alshamali (2013)	1995 to 2008	VAR	Texas Cities (United States)	Mixed result
Herrera, Lagalo and Wada (2014)	1998 to 2012	NARDL	OECD	Mild Support for asymmetry
Hu et al. (2017)	August 2004 to August 2016	SVAR and NARDL	China	oil price significantly affect the China's stock market
Jo (2014)	1958Q2 to 2008Q3	VECM	Globe	Negative effect oil price shocks on global economic activity
Melichar (2016)	July 1979 to June 2011	David-Mckinnon J-test		Models with alternative energy price give better

				forecast than model with oil price
Aydın and Acar (2011)	Simulation	CGE	Turkey	Significant effect
Doğan, Ustaoğlu and Demez (2012)	February, 2001, to July, 2011	Perron veKejriwal test	Turkey	Positive effect on real exchange rate
Katircioglu, Katircioglu and Altun (2018)	1960 to 2017	ECM	Turkey	Negative impact on economic growth
Rasasi and Yilmaz (2016)	1987:Q1 to 2015:Q2	SVEC	Turkey	Economic growth positively responds to oil price shocks
Gökçe (2013)	1987:Q1 to 2011:Q4	GARCH, VAR	Turkey	Oil price volatility has negative effect on economic growth
Ozturk (2015)	1990Q1 to 2011Q4	VAR	Turkey	Negative effect on industrial activity

3.4 Summary

This provides the chronological development of literature on the relationship between economic activity and oil price in different countries or group of countries. Several conclusions are made about the previous studies in this area. The effect of oil price on economic activity has received keen attention and that several studies examined the relationship between oil price and economic activity. However, only a few studies pay attention to the Turkish economy, employ long span of data. Therefore this study employs monthly data series to impact of oil price shocks on economic activity in Turkey.

CHAPTER 4

METHODOLOGY AND DATA ANALYSIS

4. Introduction

In this chapter, we will discuss and explain the variables, sources of the variables and the econometric methodology used in the study. This involves providing the name of the variables, their calculations, explanation about the unit root testing procedure and explanation about Blanchard and Quah Decomposition (BQD). This chapter is written based on Enders (2015) and Asteriou and Hall (2011). Additionally, this chapter discusses the preliminary and final results of analysing the relationship between Turkey's economic activity and oil price shocks. The sample period spans from January, 2000 to June, 2017. Taking the lag of dependent and explanatory variable in the vector autoregressive (VAR) model causes a loss of some observations at the beginning of the sample period. The prerequisite for estimating BQD is that at least one variable is integrated of order one and the estimation is done after transforming all non-stationary variables to stationary. This chapter is written based on Enders (2015) and Asteriou and Hall (2011).

4.1 Method of Data Collection

The study will employ time series data estimation technique, from January, 2000 to June, 2017, to empirically examine the impacts of oil price shocks on economic activity in Turkey. The choice of the sample period and the data frequency is avoid multiple breaks in the variables and to ensure availability of the data.The data for each of the variables were obtained from secondary source. Industrial Production Index (Y) was obtained from the International Financial Statistics (IFS) database, while the series for international oil price is available at Fed Reserve database.

4.2 Method of Data Analysis

This study will use Structural Vector Autoregression (SVAR) in order to examine the impact of oil price shock on the economic activity in Turkey. Blanchard and Quah (1989), Sebti (1997), Lee (1998) are some of the authors who employed the same estimation econometric technique in modeling the impact of oil price shock on the economic activity. The SVAR technique is appropriate given the fact it allows decomposing the impact into temporary and permanent.

International oil price becomes stationary at the first difference, while the growth in the industrial production index is stationary at levels. Technically, international oil price is I(1), while the growth of industrial production index is I(0). This combination makes it suitable to use the Blanchard and Quah Decomposition (BQD).

To ensure the suitability of the using the data series for BQD, empirical tests of unit root are conducted. Augmented Dickey-fuller (ADF) and its counterpart Phillips-Perron (PP) are employed for the sake of determining the order of integration of the series. The optimal lag length is manually determined in ADF test, and the optimal bandwidth size in PP test is automatically selected by the Schwarz Information Criterion (SIC). Both the two tests show that, at 5 per cent significance, international oil price is integrated of order one, while the growth of industrial production index is integrated of order 0. This mixture of I(1) and I(0) variables makes BQD suitable.

Microsoft Excel 2010 is the tool for processing the data, and Eviews 10 is used for the time series estimation.

4.3 Model Specification

In order to investigate the impact of oil price shocks on the economic activity in Turkey, it is pertinent to note that there are several factors other than oil price that exerts influence on the economic activity. However, this study is limited to the bivariate analysis of the relationship between the oil price shocks and economic activity.

$$\Delta \ln Y_t = f(P_t) \quad 4.1$$

Where;

- Δ is a difference operator
- Y is the economic activity
- P is the oil price
- Subscript t signifies time in months
- ln stands for natural logarithms and
- U_t is the white noise error term.

First difference and logarithm of the economic acitivity is taken in order calculate the growth of economic activitiy of Turkey.

4.3.1 Economic activity

This study uses Turkish industrial production index to represent the economic activity. The higher the level of economic activity in Turkey, the higher demand for oil, which can lead to increase in oil price. In other words, an increase in the economic activity in Turkey may likely to be positively related to the oil price. The converse is often equally the case. In other words, there exists a positive relationship economic activity in Turkey and oil price.

4.3.2 International Oil Price

Series of international oil price is used to represent the oil price in this study. Increase in oil price expected to lead to rise economic activity in Turkey, because it is an oil producing country.

4.4 Unit Root Test

To test the stationarity of the variables, this study employs Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test procedures. Each of these tests discussed separately below, starting with ADF.

Dickey and Fuller (1979) pioneered the procedure for unit root test. The procedure is extended (augmented) by adding lagged terms of the dependent variables with a view to eliminating autocorrelation. The number of lags in this study is chosen by considering the number of lags enough to "whiten" the residuals. For this reason, the residuals of the ADF regression are subjected to autocorrelation test, LM test in particular, to make sure that they are white noise.

The following equations provide the three possible forms of the ADF test:

$$\Delta Y_t = \alpha_0 + + \alpha_2 t + \delta Y_{t-1} + \sum_{i=1}^{k} \theta \Delta Y_{t-k} + u_t \qquad (1)$$

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \alpha_2 t + \sum_{i=1}^{k} \theta \Delta Y_{t-k} + u_t \qquad (2)$$

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{k} \theta \Delta Y_{t-k} + u_t \qquad (3)$$

In the above equations, ΔY_t stands for the change in the dependent variable, α_2 is a coefficient of a time trend t, α_0 is a constant term, ΔY_{t-k} is the set of lagged independent variables, u_t is a white noise error term, which is expected to be white noise at certain lag-length k.. The presence or absence of the presence of the deterministic elements α_0 and α_2t is what distinguish the three equations.

Specifically, the procedure for ADF unit root test is all about testing the hypotheses outlined below:

H_0: δ = 0

H_1: δ > 0

The null hypothesis H_0 implies that Y_t is not stationary or Y_t has a unit root, while the alternative hypothesis H_1 indicates that Y_t is stationary.

Asteriou and Hall (2011) contend that Phillips and Perron (1988) worked on how to generalize the ADF test procedure in order to address the wrong assumption of the ADF that "the error terms are statistically independent and have a constant variance". The test regression for the PP test can be summarized in the form of AR(1) process:

$$\Delta Y_{t-1} = \alpha_0 + \delta Y_{t-1} + \alpha_{2t} + e_t \tag{4}$$

$$\Delta Y_{t-1} = \alpha_0 + \delta Y_{t-1} + e_t \tag{5}$$

$$\Delta Y_{t-1} = \alpha_0 + \delta Y_{t-1} + e_t \tag{6}$$

In equations (4), (5) and (6) above, ΔY_{t-1} is the change in the lagged dependent variable, α_0 represents the constant term, while α_2 is a coefficient attached to the time trend t, Y_{t-1} is the first lag of the exogenous variable, and u_t is by assumption a white noise error term. As in equations (1) to (3), the only thing that distinguishes the three regressions is the presence or absence of constant and time trend terms.

Similar to ADF, PP unit root test tries to test the following set of hypothesis:

H_0: δ = 0

H_1: δ > 0

The null hypothesis H_0 implies that Y_t is not stationary or Y_t has a unit root, while the alternative hypothesis H_1 indicates that Y_t is stationary.

The unit root test procedure consists of estimation of the most general model and then answering some set of questions pertaining to the coefficient of the first lag of independent variable. The procedure is summarised in the following figure 4.1.

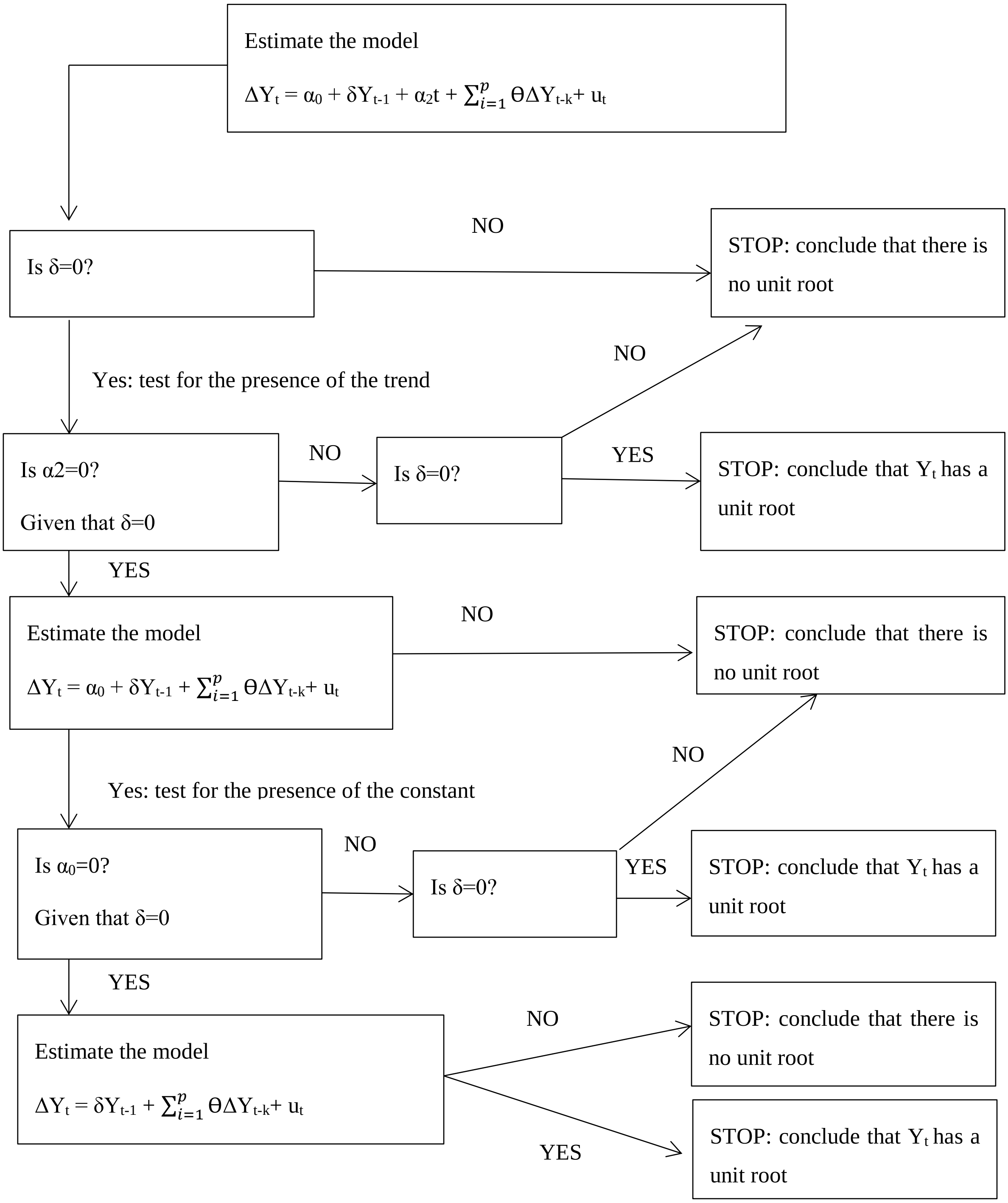

Figure 4.1: Procedure for Testing for Unit Root

Source: Enders (2015)

4.5 Vector Autoregression

Blanchard and Quah (1989) developed the following procedure whose objective is to recover the structural shocks after reduced form VAR is estimated. They aim to extend the Beveridge and Nelson (1981) decomposition of real GNP into its temporary and permanent components. For this purpose, they established a macroeconomic model in a way that real GNP is determined by both demand-side and supply-side shocks. Using an n-variable VAR, the procedure proposed by Blanchard and Quah can be used to recover the pure shocks. Given the structural model:

$$Y_t = A_0 Y_t + A_1 Y_{t-1} + A_2 Y_{t-2} + \ \dots\dots\dots + A_p Y_{t-p} + U_t \tag{7}$$

where A_0 is a matrix of contemporaneous effects, A_j where j = 1……….. p, are matrices of lagged effects, and U_t is a vector of structural shocks, which by assumption is orthogonal, and E(Ut,Ut') =Ω is a diagonal variance-covariance matrix.

To consider a general example, this study is aimed at decomposing an I(1) oil price series into its temporary and permanent components. The second variable influenced by these two shocks is the Turkish economic activity. For the fact that economic activity variable is stationary. After ignoring deterministic terms, the bivariate moving average can written as follows, following Enders (2014):

$$\Delta P_t = \sum_{q=0}^{\infty} a_{11}(q)\varepsilon_{1t-q} + \sum_{q=0}^{\infty} a_{12}(q)\varepsilon_{2t-q} \tag{8}$$

$$Y_t = \sum_{q=0}^{\infty} a_{11}(q)\varepsilon_{1t-q} + \sum_{q=0}^{\infty} a_{12}(q)\varepsilon_{2t-q} \tag{9}$$

Or, in matrix form

$$\begin{bmatrix} \Delta P_t \\ Y_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{bmatrix} \times \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

Where ε_{1t} and ε_{2t} are independent white-noise disturbances with constant variance, Aij(L) are polynomials in the lag operator L. When shocks are normalized, that is var(ε_1)=1 and var(ε_2)=1, the variance/covariance matrix $\Sigma\varepsilon$ can be written as follows

$$\sum\varepsilon = \begin{bmatrix} var(\varepsilon_1) & \text{cov}(\varepsilon_1, \varepsilon_2) \\ cov(\varepsilon_1, \varepsilon_2) & var(\varepsilon_2) \end{bmatrix}$$

$$\sum\varepsilon = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

4.6 Empirical Results

This section covers the initial results of analysing the impact of oil price shocks on economic activity in Turkey. The sample period runs from January, 2000 to December, 2017. Some observations are lost due to the use of lagged explanatory variables in the VAR. The estimation period is January, 2000 to June, 2017. The augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test are used determine the order of integration of the individual time series.

4.6.1 Unit Root Test Results

In order to have a reliable and valid result concerning the relationship oil price shocks and economic activity in Turkey, a stationarity testing using ADF and PP unit root testing needs to be carried out. This is done with a view to checking the order of integration and making sure that none of the variables is I (2). In other words, the aim of the unit root test is to ensure variable of greater order of integration than one is not included in the activity-oil-price equation.

Table 4.1: ADF Unit Root Test Results

ADF AT LEVEL					
Variable	Deterministic Trend	Test Value	5% Critical Value	Prob	Decision
ΔY	C	-3.162468	-2.876047	0.0238	I(0)
ΔY	C&T	-3.178388	-3.432799	0.0918	I(1)
ΔY	N	-2.705350	-1.942448	0.0069	I(0)
lp	C	-1.784472	-2.875262	0.3875	I(1)
lp	C&T	-1.519314	-3.431576	0.8201	I(1)
lp	N	0.055086	-1.942361	0.6993	I(1)
ADF AT FIRST DIFFERENCE					
ΔY	C	-15.10933	-2.876123	0.0000	I(0)
ΔY	C&T	-15.07455	-3.432917	0.0000	I(1)
ΔY	N	-15.14712	-1.942456	0.0000	I(0)
lp	C	-11.49593	-2.875262	0.0000	I(1)
lp	C&T	-11.53344	-3.431576	0.0000	I(1)
lp	N	-11.51852	-1.942361	0.0000	I(1)

Note: the selection of lag length k is "user-defined". I(1) signifies the rejection of the null hypothesis that the variable is non-stationary at the 5% significance level . I(0) means do not reject the null hypothesis, and ** represents MacKinnon (1996) one-sided p-values.

Table 4.2: Phillips-Perron Unit Root Test Results

PP AT LEVEL					
ΔY	C	-3.162468	-2.876047	0.0238	I(0)
ΔY	C&T	-3.178388	-3.432799	0.0918	I(1)
ΔY	N	-2.651460	-1.942448	0.0081	I(0)
lp	C	-1.794580	-2.875195	0.3825	I(1)
lp	C&T	-1.385814	-3.431471	0.8625	I(1)
lp	N	0.167979	-1.942353	0.7340	I(1)
PP AT FIRST DIFFERENCE					
ΔY	C	-15.10239	-2.876123	0.0000	I(0)
ΔY	C&T	-15.06949	-3.432917	0.0000	I(0)
ΔY	N	-15.13946	-1.942456	0.0000	I(0)
lp	C	-11.49453	-2.875262	0.0000	I(1)
lp	C&T	-11.52250	-3.431576	0.0000	I(1)
lp	N	-11.51842	-1.942361	0.0000	I(1)

Note: the selection of lag length k is "user-defined". I(1) signifies the rejection of the null hypothesis that the variable is non-stationary at the 5% significance level . I(0) means do not reject the null hypothesis, and ** represents MacKinnon (1996) one-sided p-values.

Our unit root test results obviously reveal that the variables are a mixture of I(1) and I(0), none is I(2). This makes it suitable for the BQD.

4.6.2 The unrestricted VAR

After confirming the absence of I(2) in all the variables used in the given model model, an unrestricted VAR is estimated. The next important task is to check the stability of the VAR, determine the optimal lag and run diagnostic checks. To do that, the VAR is estimated and determine the optimal lag selected by the information criteria.

Table 4.3: Lag selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-454.0435	NA	0.416739	4.800458	4.834638	4.814304
1	-291.2037	320.5374	0.078294*	3.128460*	3.230998*	3.169996*
2	-290.4005	1.564154	0.080975	3.162110	3.333006	3.231338
3	-285.7113	9.032785	0.080393	3.154856	3.394111	3.251775
4	-284.5610	2.191649	0.082847	3.184853	3.492466	3.309462
5	-283.3819	2.221664	0.085354	3.214547	3.590518	3.366847
6	-278.0785	9.881035*	0.084205	3.200827	3.645156	3.380818
7	-277.3914	1.265702	0.087214	3.235699	3.748387	3.443382
8	-272.6184	8.691981	0.086533	3.227562	3.808608	3.462935

* 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

Table 4.3 reveals that the values for the information criteria related to the unrestricted VAR. The values of FPE, AIC, SC and HQ indicate that the optimal lag is one (1), while LR chooses six (6) lags as optimal. Hence, the optimal lag lies between these two extreme numbers of lags. The table gives guide on the range of possible optimal lags for the unrestricted VAR. We began by estimating the unrestestricted VAR using one lag, but residual test indicates the presence of autocorrelation and heteroscedasticity. Unrestricted VAR with two and three lags also do not meet the requirement of the residual test. However the unrestricted VAR with four lags pass the autocorrelation and heteroscedasticity tests, as shown in Table 4.5. Therefore, the optimal number of lags is determined to be four (4), as it the minimum number of lags that is capable of dealing with autocorrelation and heteroskedasticity. The decision whether to include the deterministic term or not is made after plotting the graphs of each of the dependent variables.

As guided by the BQ decomposition, a stable unrestricted VAR is required before the imposition of the long run restrictions. **Table 4.4** is showing the unrestricted VAR estimated before the imposition of the long run restrictions. The the equation of Y in the table shows that growth of Turkey's economic activity is positively related to the change in oil price at first, third and fourth lags, but negatively related at second lag. The equation of ΔP indicates that change in oil price is positively related at first, second and fourth lags, but negatively related at third lags. In short, the growth of Turkey's economic activity is positively related with the change in oil price. However, the important thing is that unrestricted VAR needs to be estimated before imposing the long run restriction or BQ decomposition.

Table 4.4: Unrestricted VAR

Equation of Y									
	Y(-1)	Y(-2)	Y(-3)	Y(-4)	ΔP(-1)	ΔP(-2)	ΔP(-3)	ΔP(-4)	C
Y	0.827	0.150	-0.040	-0.072	4.265	-1.410	5.092	0.440	0.627
se	-0.074	-0.096	-0.096	-0.072	-2.768	-2.837	-2.827	-2.770	-0.273
t	11.142	1.5653	-0.415	-0.993	1.5408	-0.4970	1.8011	0.1587	2.2970
Equation of ΔP									
ΔP	0.002	0.001	-0.003	0.001	0.261	-0.003	-0.028	-0.064	-0.001
se	-0.002	-0.003	-0.003	-0.002	-0.074	-0.076	-0.076	-0.074	-0.007
t	1.16247	0.28812	-1.20269	0.37615	3.50529	-0.0458	-0.3744	-0.8619	-0.1013

Note: y and ΔP are the variables for the unrestricted VAR, while t and se stand for t-statistic and standard error respectively.

4.6.3 Stability of VAR

To make sure that the unrestricted VAR is invertible, we check the position of the characteristic roots in relation to the unit circle. **Figure 4.1** shows that inverse roots of AR characteristic polynomial lie within the unit cycle. In other words, the unrestricted VAR is stable and invertible at the fourth lag.

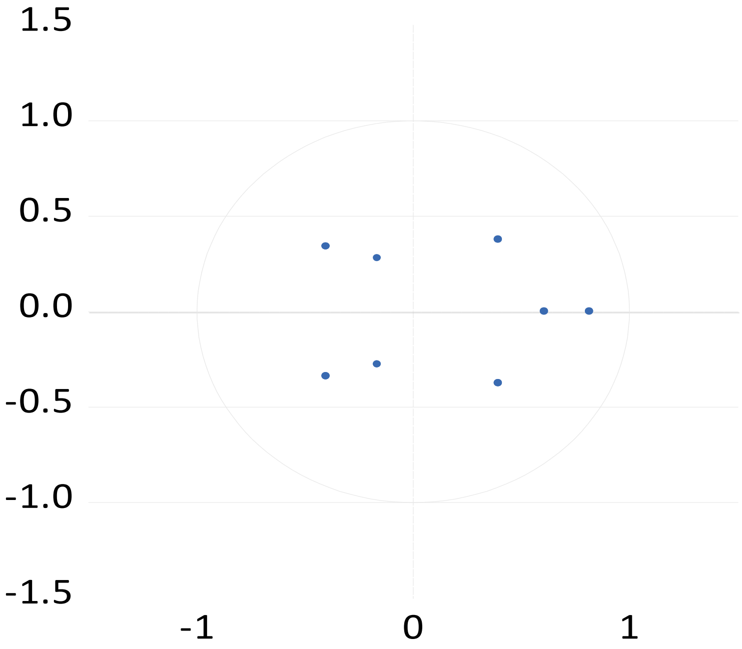

Figure 4.1: Inverse Roots of AR Characteristic Polynomial

4.6.4 Diagnostic Results

This section is devoted to checking the behaviour of the error term from the unrestricted VAR. **Table 4.5** presents the diagnostic tests for the residual of the unrestricted VAR. As shown in the table, the residuals of the unrestricted VAR are free of serial correlation and heteroscedasticity and are multivariate normal as their respective probabilities are greater than per cent (0.05). In other words, we cannot reject the null hypotheses of no autocorrelation, no heteroscedasticity and residuals are multivariate normal.

Table 4.5: Residual Diagnostics

Test	Sc.	Het.	Norm.
Test value	1.147933(0.18)	169.4741(0.08)	2.822843(0.24)

SC, Het and Norm stand for serial correlation, heteroscedasticity and normality respectively. Probabilities are given in parenthesis

4.7 Impulse Response

This section employs impulse response analysis to examine the response of the growth in economic activity due to its own shocks, and the shocks of oil price. We also consider the other way round. **Figure 4.2, Figure 4.3, Figure**

4.4 and **Figure 4.5** present the impulse response related to the transitory impact of the oil price shocks, while **Figure 4.6, Figure 4.7, Figure 4.8** and **Figure 4.9** explain the response to growth of Turkish economic activity due to the permanent effect of the oil price shocks. As shown in shown in the figures for transitory shocks, it is clear that all the response paths decay to zero after some months.

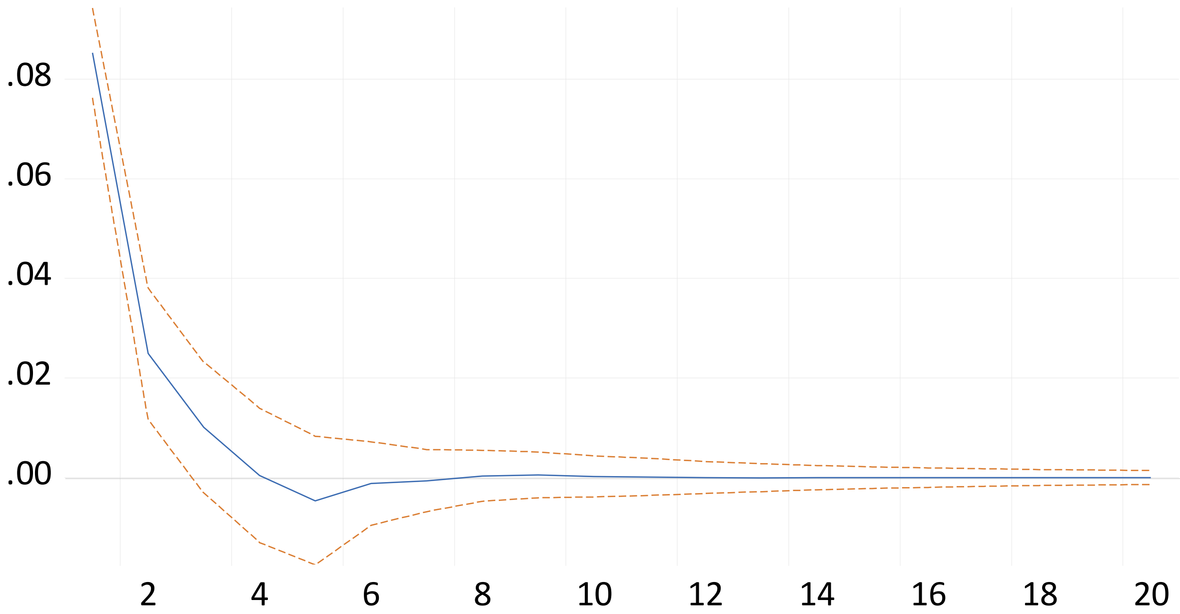

Figure 4.2: Response of oil price to its own shock

Figure 4.3 reports the response of oil price to growth of economic activitiy shocks. As shown in the figure, it can be seen that shocks to growth of economic activitiy can lead to oil price to fall by little percentage, and the effect of the shocks decay to zero in two (2) months.

As shown in Figure 4.4, shocks to the oil price cause the economic activity to rise by 1 per cent. However after a period of approximately twenty (20) months, the effect of the oil price shocks decay to zero. In other words, the response of economic activity to oil price shocks is positive, and the effects of the activity shocks reverts to equilibrium after twenty (20) months, approximately.

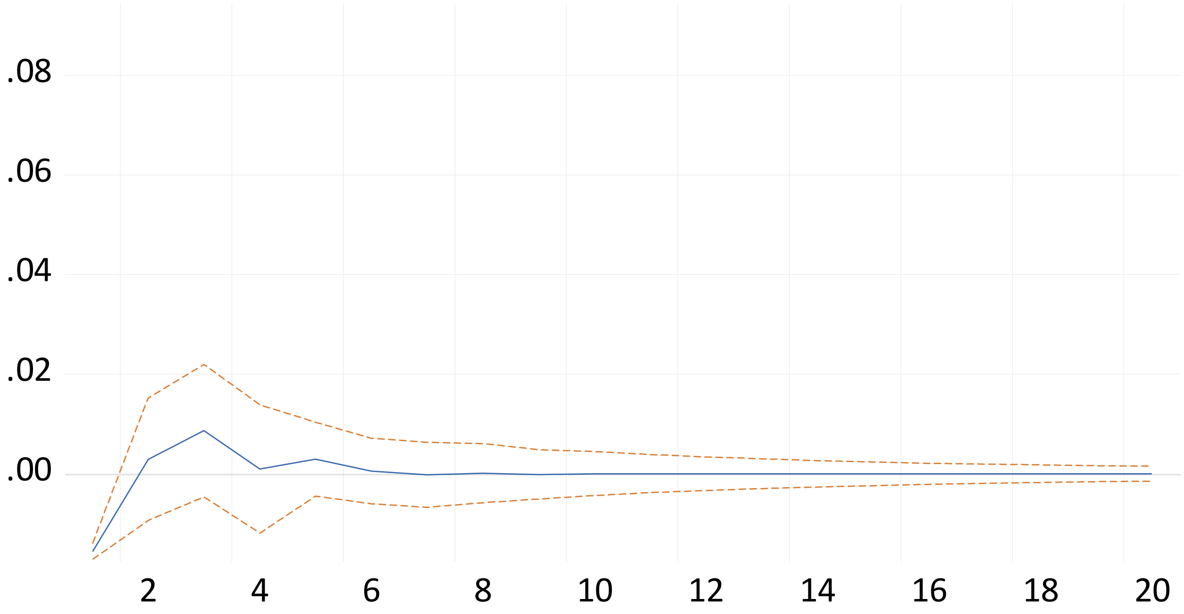

Figure 4.3: Response of oil price to growth of economic activity shocks

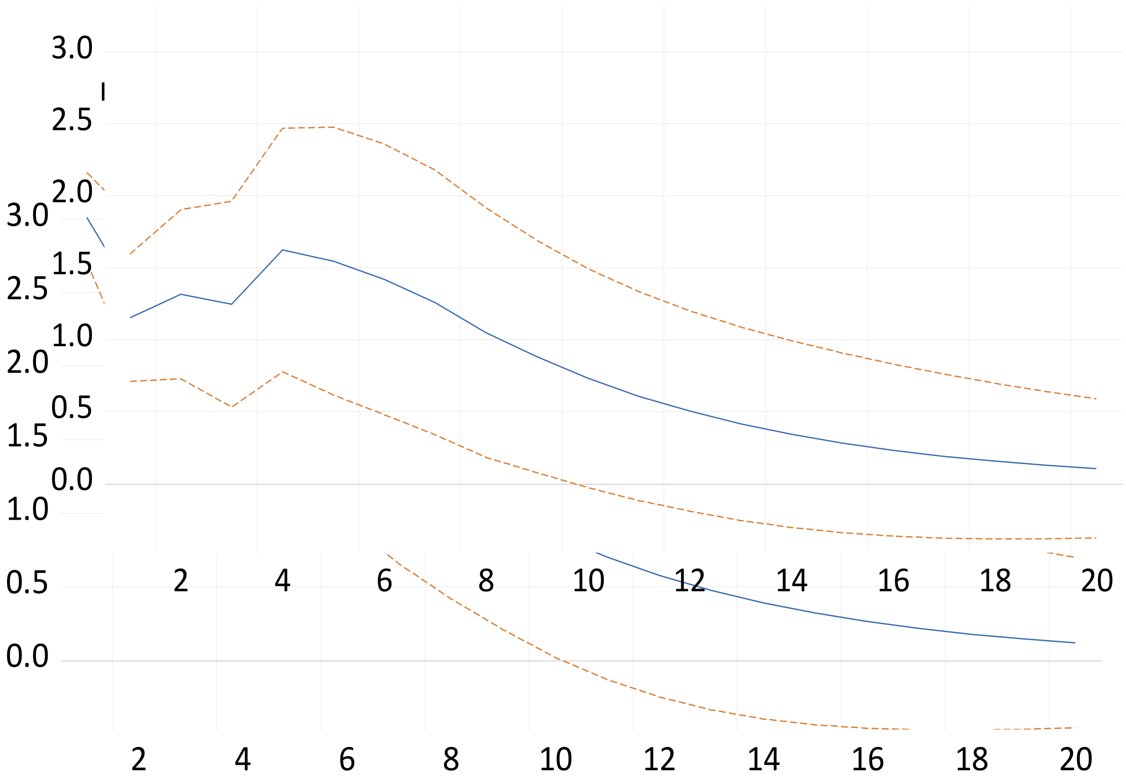

Figure 4.5: Response of growth of economic activity to its own shocks

Figure 4.6, Figure 4.7, Figure 4.8 and **Figure 4.9** present the accumulated response of oil price and growth of economic activity. **Figure 4.7** presents the path of response of oil price to growth of economic activitiy shocks. It shows that growth of economic activitiy shocks have zero effect on oil price.

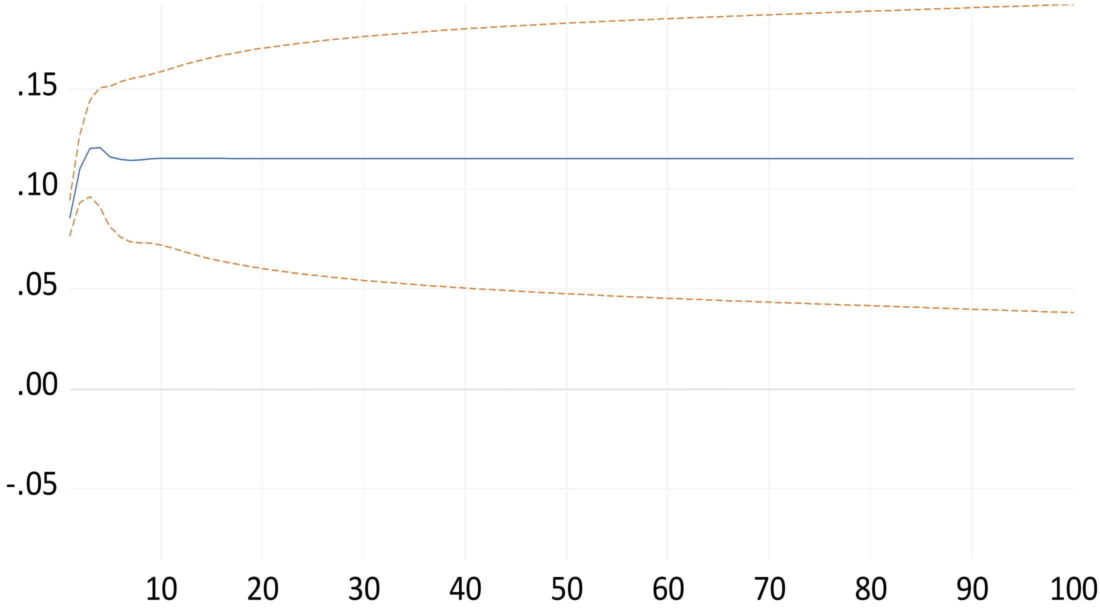

Figure 4.6: Permanent response of oil price to its own shocks

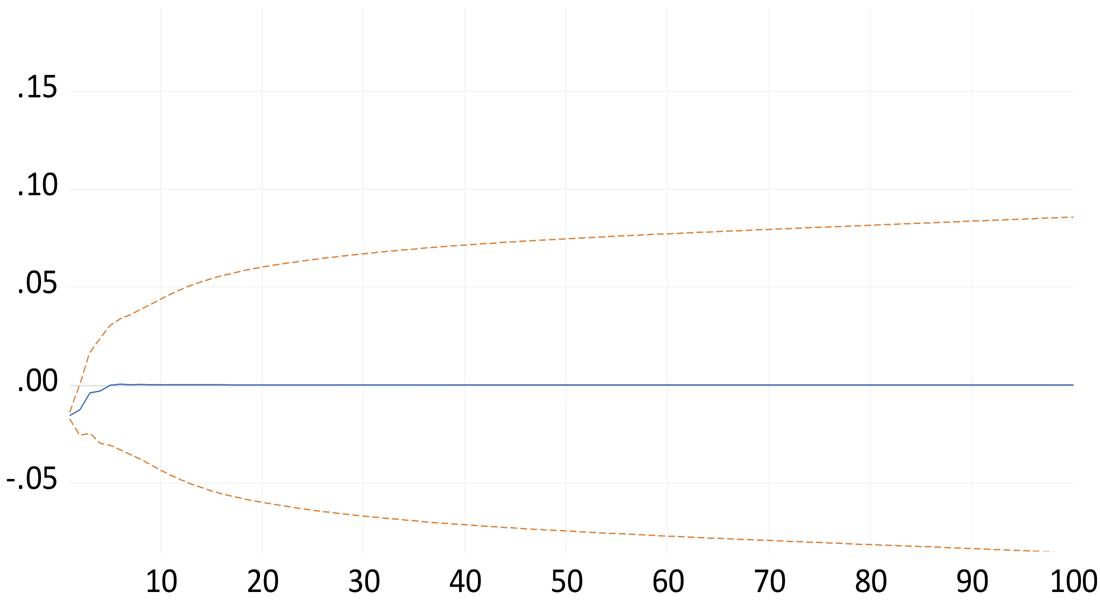

Figure 4.7: Permanent response of oil price to growth of economic activity shocks

Figure 4.8 indicates that the permanent effect of the oil price shocks to Turkish economic activity. The figure further reveals the permanent effect of oil price shocks on the Turkey’s economic activity as the path of the impulse response never decays to zero.

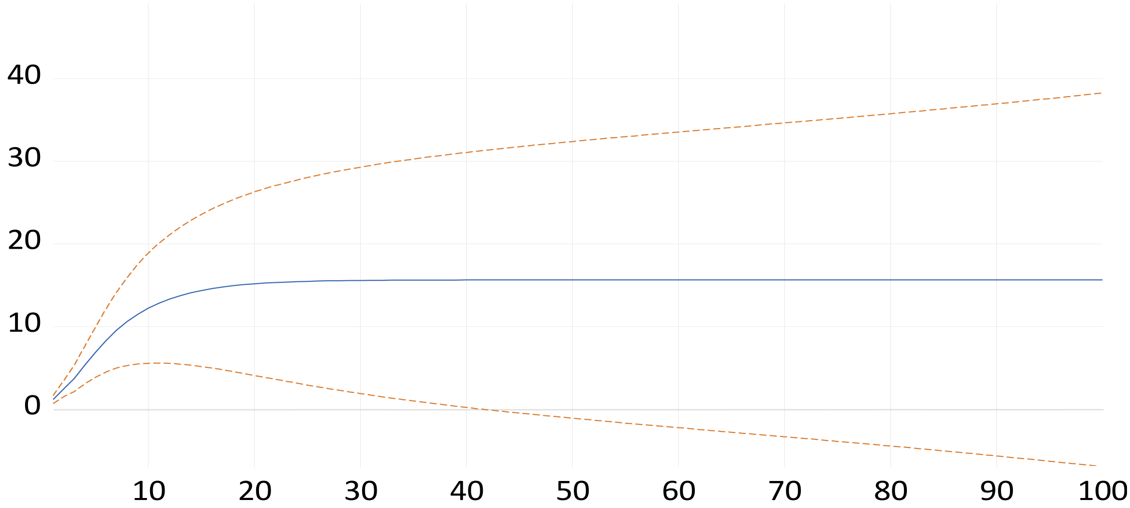

Figure 4.8: Permanent response of growth of economic activity to oil price shocks

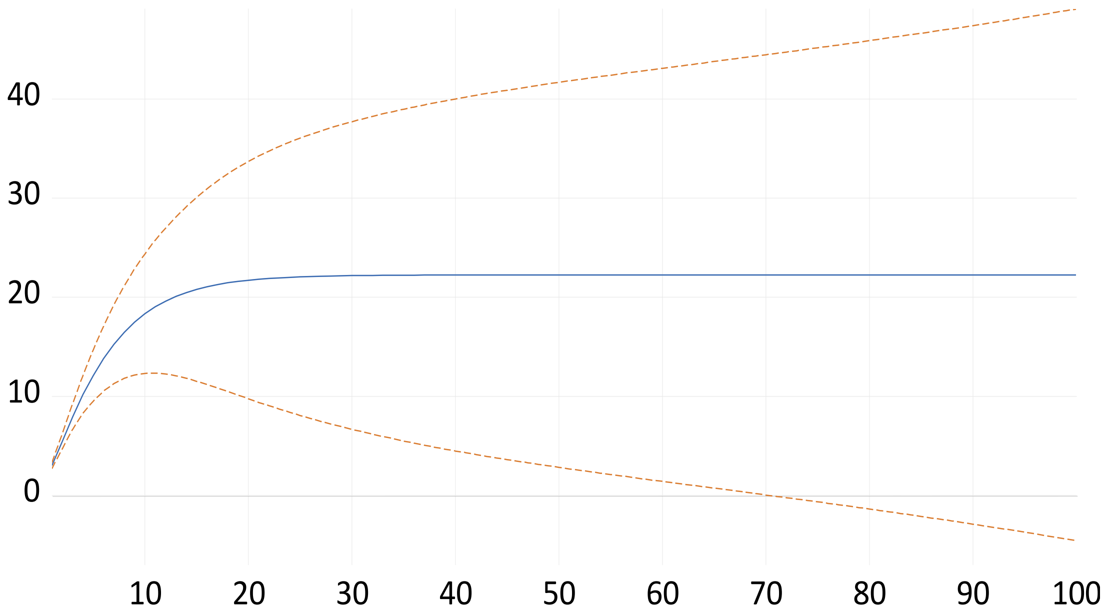

Figure 4.9: Permanent response of growth of economic activity to its own shocks

The foregoing analysis of the impulse response has some implications. The temporary impulse response analysis indicates the short run analysis while the permanent impulse response show the long run analysis. The temporary impulse response analysis shows that growth of economic activitiy negatively relates to the oil price and, on the other hand, oil price shocks positively affects the growth of economic activitiy in Turkey. However, the permanent impulse response indicates that oil price shocks has permanent positive effect on the growth of economic activitiy of Turkey, while the latter has no permanent effect on the former.

4.8 Variance Decomposition

Variance decomposition serves as a tool for the separating the forecast error coming from each variable used in the VAR. **Table 4.6** reports the variance decomposition of oil price and **Table 4.7** contains the estimates of variance decomposition of growth of economic activitiy. From **Table 4.6**, about 96.75 per cent of the variance forecast error for oil price comes from its shown shock, while shocks from growth of economic activitiy explain 3.25 per cent. Even at longer horizon of 40 months, the shocks from the growth of economic activitiy do not go beyond 4.04 per cent.

On the other hand, **Table 4.4** shows that shocks from oil price constitute up to 12.74 per cent of the forecast error variance of the Turkish growth of economic activitiy . The magnitude even increases at the longer horizon of five (5) months, and even higher magnitude 29.73 per cent is obtained at longer horizon. This stresses the importance of oil price shocks in determining the forecast error variance of the Turkish growth of economic activitiy .

The implication of the above analysis for variance decomposition is that the growth of Turkey's economic actitivity is too small to influence the international oil price, but international oil price is so strong that it has significant influence on the Turkish economy.

Table 4.6: Variance Decomposition of Oil Price

Period	S.E.	Oil price shocks	growth of economic activity
1	0.086693	96.75165	3.248348
2	0.090249	96.89873	3.101265
3	0.091225	96.06327	3.936731

4	0.091231	96.05290	3.947104
5	0.091396	95.96474	4.035262
6	0.091405	95.96210	4.037900
7	0.091408	95.96181	4.038193
8	0.091408	95.96171	4.038295
9	0.091410	95.96159	4.038414
10	0.091410	95.96160	4.038395
11	0.091410	95.96161	4.038393
12	0.091410	95.96161	4.038394
13	0.091410	95.96161	4.038393
14	0.091410	95.96160	4.038397
15	0.091410	95.96160	4.038401
16	0.091410	95.96160	4.038404
17	0.091410	95.96159	4.038407
18	0.091410	95.96159	4.038408
19	0.091410	95.96159	4.038410
20	0.091410	95.96159	4.038410
21	0.091410	95.96159	4.038411
22	0.091410	95.96159	4.038411
23	0.091410	95.96159	4.038411
24	0.091410	95.96159	4.038412
25	0.091410	95.96159	4.038412
26	0.091410	95.96159	4.038412
27	0.091410	95.96159	4.038412
28	0.091410	95.96159	4.038412
29	0.091410	95.96159	4.038412
30	0.091410	95.96159	4.038412
31	0.091410	95.96159	4.038412
32	0.091410	95.96159	4.038412
33	0.091410	95.96159	4.038412
34	0.091410	95.96159	4.038412
35	0.091410	95.96159	4.038412
36	0.091410	95.96159	4.038412
37	0.091410	95.96159	4.038412
38	0.091410	95.96159	4.038412
39	0.091410	95.96159	4.038412
40	0.091410	95.96159	4.038412

Table 4.7: Variance Decomposition of Growth of economic activitiy

Period	S.E.	Oil price shocks	growth of economic activity
1	3.224639	12.74289	87.25711
2	4.242746	16.97132	83.02868
3	5.073741	17.89254	82.10746
4	5.783869	21.64090	78.35910

5	6.287503	24.34922	75.65078
6	6.668135	26.16912	73.83088
7	6.936487	27.46813	72.53187
8	7.120721	28.23481	71.76519
9	7.247681	28.73481	71.26519
10	7.333601	29.06218	70.93782
11	7.392037	29.27806	70.72194
12	7.431665	29.42595	70.57405
13	7.458445	29.52568	70.47432
14	7.476535	29.59317	70.40683
15	7.488711	29.63866	70.36134
16	7.496896	29.66914	70.33086
17	7.502391	29.68960	70.31040
18	7.506076	29.70331	70.29669
19	7.508547	29.71250	70.28750
20	7.510203	29.71866	70.28134
21	7.511313	29.72279	70.27721
22	7.512056	29.72555	70.27445
23	7.512553	29.72741	70.27259
24	7.512886	29.72865	70.27135
25	7.513109	29.72948	70.27052
26	7.513258	29.73003	70.26997
27	7.513358	29.73041	70.26959
28	7.513425	29.73065	70.26935
29	7.513470	29.73082	70.26918
30	7.513500	29.73093	70.26907
31	7.513520	29.73101	70.26899
32	7.513533	29.73106	70.26894
33	7.513542	29.73109	70.26891
34	7.513548	29.73111	70.26889
35	7.513552	29.73113	70.26887
36	7.513555	29.73114	70.26886
37	7.513557	29.73114	70.26886
38	7.513558	29.73115	70.26885
39	7.513559	29.73115	70.26885
40	7.513559	29.73115	70.26885

4.9 Findings

The forgoing data analysis reveals some major findings for this study. The study reveals that Turkey is small economy as its growth has very little influence on the international oil price, as indicated by the analysis of the variance decomposition. Moreover, the study shows that growth of economic activitiy shocks negatively affect the oil price and, on the other hand, oil price shocks positively affects the growth of economic activitiy in Turkey in the short run. Additionally, oil price shocks can permanently cause growth of economic activitiy of Turkey to rise. Furthermore, Turkey’s growth of economic activitiy leaves oil price unaffected in the long run.

The result of this study contradicts the findings of Aydın and Acar (2011), Doğan, Ustaoğlu and Demez (2012), Katircioglu, Katircioglu and Altun (2018), Gökçe (2013), Ozturk (2015). The reason for this contradiction could be as a result of using different proxy for economic activity and different econometric methododolgy. However this study is in conformity with Rasasi and Yilmaz (2016), as they find positive response of growth of economic activitiy to oil price shocks. This conformity can be attributable to using similar econometric methodology: this study uses SVAR, while Rasasi and Yilmaz (2016) uses SVEC.

4.10 Summary

This chapter presents the variables employed in this study, the sources of the variables and their expected theoretical signs. The chapter also provides the theoretical background of the ADF and PP unit root test procedures, as they are main and formal unit root procedures employed in this study. Furthermore, the chapter provides the overview of the BQD, as the main econometric technique used in the study. In addition to this, the chapter presents the conduct of unit root test using ADF and PP. It is found that none of the variables is integrated of order higher than unity. Put differently, none of the variables in the Turkey's trade balance model is I(2). Moreover, it is found that one of the variable is I(1) and the other I(0). For this reason, we went ahead to estimate the unrestricted VAR and then impulse long run restriction to identify the VAR. After that, we conduct the diagnostic tests for the model to make sure its residuals are white noise. This chapter also presents the estimates of the unrestricted VAR and the results of its residual tests, and it is shown that the VAR has passed these diagnostic tests. The stability of the parameter estimates of the VAR are also investigated using unit circle.

CHAPTER 5

SUMMARY, CONCLUSION AND FURTHER RESEARCH AREAS

5. Introduction

This chapter provides the summary of the study, conclusion and suggests some areas that have not been covered by this study. In the summary section, the variables, methodology, sample and findings of this study are discussed in brief. In the conclusion section, we establish possible implications of our findings: theoretical implication, practical implication and empirical implication. Finally we propose some future research areas as this study is not assumed to be exhaustive in the area of dynamics of Turkey's economic activity and oil price shocks.

5.1 Summary

This study aims at decomposing the impact of oil price shocks on the Turkish economy into its temporary and permanent components. It involves estimating an unrestricted VAR and using the methodology proposed by Blanchard and Quah (1989) to impose long run restriction. The econometric analysis employs monthly data on Turkish industrial production index and international oil price for the period spanning January 2000 to June, 2017. The choice of the sample period and the data frequency is avoid multiple breaks in the variables and to ensure availability of the data.The data for each of the variables were obtained from International Financial Statistics. The annual growth rate of industrial production index is used to capture the growth of economic activitiy of Turkey, while the international oil price (WTI) is employed to represent the oil price. The growth of economic activitiy of Turkey is found to be I(0) and the oil price is I(1). This indicates the suitability of using Blanchard and Quah decomposition.

As seen in the empirical literature review, impulse response and variance decomposition from the SVAR is used to examine the dynamic effect of oil price shocks on the Turkish economy. Two categories of impulse response are used, the transitory impulse response and the permanent impulse response. From the transitory impulse response, it is clear that all the response paths decay to zero after some months. Shocks to the oil price cause the economic activity to rise by 1 per cent. However after a period of approximately twenty one year and eight (8) months, the effect of the oil price shocks decay to zero. In other words, the response of economic activity to oil price shocks is positive, and the effects of the activity shocks reverts to equilibrium after twenty (20) months, approximately. In addition to this, the response of oil price to growth of economic activitiy shocks is close to zero and the effect of the shocks decay to zero in two (2) months. From the permanent impulse response, it is observed that growth of economic activitiy shocks have zero effect on oil price, while the permanent effect of the oil price shocks to Turkish growth of economic activitiy never decay to zero. Based on the variance decomposition, it is obvious that oil price constitute a chunk of the forecast error variance of the Turkish growth of economic activitiy , while the growth of economic activitiy explains very little percentage. This emphasises the significance of oil price shocks in determining the forecast error variance of the Turkish growth of economic activitiy .

5.2 Conclusion

The findings of this study are intended to have practical application in Turkey's growth policy in relation to oil prices. In fact, it can also be a case for the Central Bank of Turkey to use the outcome of this study to convince the government to implement a welfare-friendly macroeconomic framework. For the fact oil price shocks affect growth of economic activitiy positively in the short run, Turkish government should put some measures in place that will monitor its growth of economic activitiy to avoid economic overheat. When permanent effect of the oil price shocks is taken into consideration, it is advisable for the government to embark on developing other sources of energy such as solar energy, wind turbine and so on to serve as shocks absorber for the economy.

5.3 Further Research Areas.

For the fact this study is not exhaustive in the area growth-oil-price relationship, the following suggestions can provide a better insight on the relationship:

- Sector-specific studies (for example study on growth manufacturing sector) may provide more information relationship between growth and oil price shocks.
- There is need to investigate the impact of oil price shocks on the economic activity of different cities in Turkey as could have a differing effects from one city to another.

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APPENDIX I

The data

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2000M01	59.86530307	25.22000000	3.22763733	
2000M02	61.96058868	27.63000000	3.31890214	
2000M03	60.86305812	27.47000000	3.31309450	
2000M04	62.35969070	22.54000000	3.11529151	
2000M05	63.25767024	27.40000000	3.31054301	
2000M06	64.15564979	29.68000000	3.39047342	
2000M07	64.45497630	28.51000000	3.35025490	
2000M08	66.05138439	29.89000000	3.39752398	
2000M09	63.35744575	32.62000000	3.48492560	
2000M10	64.35520080	30.93000000	3.43172659	
2000M11	65.15340484	32.52000000	3.48185528	
2000M12	62.45946620	25.28000000	3.23001357	
2001M01	60.26440509	25.64000000	3.24415363	0.66445427
2001M02	60.86305812	27.41000000	3.31090791	-1.78721248
2001M03	57.27113994	24.40000000	3.19458313	-6.08295608
2001M04	56.97181342	25.55000000	3.24063732	-9.03624401
2001M05	56.77226241	28.45000000	3.34814816	-10.81685203
2001M06	57.17136443	27.72000000	3.32215417	-11.52590075
2001M07	57.96956847	24.54000000	3.20030444	-10.60487469
2001M08	59.66575206	25.67000000	3.24532299	-10.16748020
2001M09	59.36642554	25.54000000	3.24024585	-6.50635933
2001M10	55.97405837	20.48000000	3.01944880	-13.95294113
2001M11	57.07158892	18.94000000	2.94127609	-13.24381379
2001M12	56.97181342	18.60000000	2.92316158	-9.19611614

Year	**Industrial production index**	**Oil price**	**Logarithm of oil price**	**Annual growth rate of industrial production index**
2002M01	58.86754802	19.48000000	2.96938830	-2.34516610
2002M02	62.25991519	20.29000000	3.01012815	2.26914112
2002M03	62.95834373	23.69000000	3.16505302	9.46764662
2002M04	64.15564979	25.65000000	3.24454357	11.87555146
2002M05	62.16013969	25.43000000	3.23592958	9.06660847
2002M06	62.75879272	24.13000000	3.18345588	9.32455400
2002M07	63.35744575	25.77000000	3.24921102	8.88742420
2002M08	63.65677226	26.63000000	3.28203840	6.47475294
2002M09	65.35295585	28.34000000	3.34427423	9.60738301
2002M10	63.85632327	27.55000000	3.31600254	13.17472708
2002M11	62.45946620	24.50000000	3.19867312	9.02113797
2002M12	66.35071090	28.52000000	3.35060560	15.23978310
2003M01	68.24644550	31.29000000	3.44329856	14.78353807
2003M02	66.25093540	32.65000000	3.48584486	6.21317811
2003M03	67.34846595	30.34000000	3.41246697	6.74068283
2003M04	65.35295585	25.02000000	3.21967551	1.84905114
2003M05	65.35295585	25.81000000	3.25076201	5.00887168
2003M06	68.04689449	27.55000000	3.31600254	8.08984011
2003M07	69.64330257	28.40000000	3.34638915	9.45941039
2003M08	71.33948616	29.83000000	3.39551460	11.39442593
2003M09	71.33948616	27.10000000	3.29953373	8.76473071
2003M10	70.64105762	29.59000000	3.38743647	10.09759173
2003M11	70.34173111	28.77000000	3.35933318	11.88474317
2003M12	71.63881267	29.88000000	3.39718936	7.66825284
2004M01	72.73634323	31.18000000	3.43977686	6.37158144
2004M02	73.43477176	30.87000000	3.42978484	10.29479693

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2004M03	73.83387378	33.80000000	3.52046080	9.19374953
2004M04	75.13095535	33.36000000	3.50735758	13.94299922
2004M05	77.22624096	37.92000000	3.63547868	16.69366380
2004M06	76.52781242	35.19000000	3.56076195	11.74571435
2004M07	77.72511848	38.37000000	3.64727590	10.97919431
2004M08	77.12646545	43.03000000	3.76189755	7.79965059
2004M09	75.53005737	43.38000000	3.76999851	5.70807107
2004M10	72.93589424	49.77000000	3.90741239	3.19693661
2004M11	73.43477176	43.05000000	3.76236223	4.30323159
2004M12	74.73185333	39.65000000	3.68009095	4.22694145
2005M01	87.20379147	44.28000000	3.79053311	18.14066436
2005M02	83.71164879	45.56000000	3.81903014	13.09805877
2005M03	82.71389374	53.08000000	3.97180021	11.35699689
2005M04	83.91119980	51.86000000	3.94854778	11.05264322
2005M05	83.61187329	48.67000000	3.88506282	7.94462269
2005M06	84.11075081	54.31000000	3.99470837	9.44801566
2005M07	85.40783238	57.58000000	4.05317529	9.42593303
2005M08	87.90222000	64.09000000	4.16028835	13.07785773
2005M09	88.50087304	62.98000000	4.14281722	15.84817289
2005M10	89.09952607	58.52000000	4.06936858	20.01731211
2005M11	88.50087304	55.53000000	4.01692342	18.66148636
2005M12	89.19930157	56.75000000	4.03865566	17.69667917
2006M01	89.19930157	63.57000000	4.15214166	2.26253995
2006M02	90.19705662	59.92000000	4.09301034	7.46186539
2006M03	92.59166875	62.25000000	4.13115854	11.28115777
2006M04	92.09279122	70.44000000	4.25476128	9.30375745

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2006M05	92.59166875	70.19000000	4.25120585	10.20136323
2006M06	93.29009728	68.86000000	4.23207546	10.35795713
2006M07	92.79121976	73.90000000	4.30271283	8.29142100
2006M08	93.38987279	73.61000000	4.29878089	6.05578505
2006M09	93.09054627	62.77000000	4.13947725	5.05602185
2006M10	92.59166875	58.38000000	4.06697337	3.84451519
2006M11	93.58942380	58.48000000	4.06868482	5.59049667
2006M12	94.48740334	62.31000000	4.13212193	5.75933180
2007M01	100.17460713	54.30000000	3.99452423	11.60415251
2007M02	97.77999501	57.76000000	4.05629649	8.07232113
2007M03	99.67572961	62.14000000	4.12938990	7.37230459
2007M04	99.87528062	67.40000000	4.21064502	8.11255448
2007M05	101.77101522	67.48000000	4.21183126	9.45261735
2007M06	99.27662759	71.32000000	4.26717679	6.21962079
2007M07	98.87752557	77.20000000	4.34639946	6.35299482
2007M08	100.77326016	70.80000000	4.25985900	7.60901334
2007M09	101.37191320	77.13000000	4.34549231	8.52234273
2007M10	100.97281117	83.04000000	4.41932242	8.66521171
2007M11	101.97056623	92.53000000	4.52753292	8.57668218
2007M12	101.77101522	91.45000000	4.51579237	7.42588131
2008M01	102.46944375	91.92000000	4.52091863	2.26499097
2008M02	104.06585183	94.82000000	4.55198036	6.23038833
2008M03	103.46719880	103.28000000	4.63744375	3.73324296
2008M04	103.76652532	110.44000000	4.70447239	3.82212128
2008M05	102.17011724	123.94000000	4.81979758	0.39138993
2008M06	102.17011724	133.05000000	4.89072500	2.87290684

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2008M07	101.37191320	133.90000000	4.89709325	2.49140938
2008M08	98.97730107	113.85000000	4.73488179	-1.79825026
2008M09	98.97730107	99.06000000	4.59572573	-2.39055209
2008M10	94.48740334	72.84000000	4.28826525	-6.63847567
2008M11	91.19481167	53.24000000	3.97480999	-11.16861993
2008M12	88.00199551	41.58000000	3.72761928	-14.53658503
2009M01	82.71389374	44.86000000	3.80354653	-21.41770548
2009M02	84.11075081	43.24250000	3.76682381	-21.28894970
2009M03	82.81366924	46.83909091	3.84671813	-22.26615074
2009M04	85.00873036	50.84523810	3.92878647	-19.93894653
2009M05	87.00424046	57.93809524	4.05937512	-16.06823817
2009M06	89.79795460	68.59363636	4.22819977	-12.90770423
2009M07	91.29458718	64.91652174	4.17310216	-10.47045629
2009M08	90.29683213	72.50476190	4.28365224	-9.17881636
2009M09	91.49413819	67.68681818	4.21489145	-7.86156350
2009M10	93.48964829	73.19409091	4.29311469	-1.06158109
2009M11	95.88426041	77.03666667	4.34428150	5.01438375
2009M12	93.38987279	74.66954545	4.31307232	5.94234205
2010M01	93.19032178	76.37300000	4.33562923	11.92562831
2010M02	95.78448491	74.31200000	4.30827245	12.99663265
2010M03	97.87977052	79.27478261	4.37292008	16.71467588
2010M04	98.77775006	84.92863636	4.44181133	15.01184163
2010M05	99.67572961	76.25095238	4.33402991	13.59653547
2010M06	99.07707658	74.83818182	4.31532821	9.83359007
2010M07	100.17460713	74.73545455	4.31395461	9.28232350
2010M08	101.97056623	76.69318182	4.33981281	12.15818271

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2010M09	101.17236219	77.78681818	4.35397198	10.05507119
2010M10	101.97056623	82.91809524	4.41785332	8.68334885
2010M11	102.86854577	85.67000000	4.45050271	7.03100750
2010M12	107.45821901	91.79652174	4.51957441	14.03192007
2011M01	109.55350461	96.29428571	4.56740898	16.17691838
2011M02	108.15664754	103.95550000	4.64396292	12.14798975
2011M03	108.65552507	114.44130435	4.74006207	10.44426634
2011M04	107.75754552	123.15047619	4.81340699	8.70113770
2011M05	108.15664754	114.45818182	4.74020953	8.16584034
2011M06	109.15440259	113.75772727	4.73407099	9.68653189
2011M07	108.75530057	116.46000000	4.75754787	8.21856750
2011M08	111.05013719	110.08130435	4.70121922	8.52975805
2011M09	108.75530057	110.87909091	4.70844034	7.22747911
2011M10	113.24519830	109.46857143	4.69563749	10.48711592
2011M11	110.35170866	110.50409091	4.70505254	7.02206981
2011M12	111.74856573	107.97000000	4.68185341	3.91492871
2012M01	111.24968820	110.99363636	4.70947287	1.53640618
2012M02	111.05013719	119.70238095	4.78500850	2.64011693
2012M03	112.44699426	124.92863636	4.82774267	3.42993911
2012M04	112.74632078	120.59095238	4.79240426	4.52565916
2012M05	113.94362684	110.52173913	4.70521224	5.21232082
2012M06	111.84834123	95.58904762	4.56005825	2.43804401
2012M07	112.64654527	103.14090909	4.63609610	3.51545889
2012M08	112.24744325	113.34000000	4.73039215	1.07239634
2012M09	112.24744325	113.38250000	4.73076706	3.16053394
2012M10	113.44474931	111.97347826	4.71826204	0.17605638

Year	**Industrial production index**	**Oil price**	**Logarithm of oil price**	**Annual growth rate of industrial production index**
2012M11	113.44474931	109.71181818	4.69785709	2.76433117
2012M12	111.14991270	109.64000000	4.69720227	-0.53715438
2013M01	112.94587179	112.92869565	4.72675661	1.51315749
2013M02	114.94138189	116.45500000	4.75750493	3.44404900
2013M03	114.34272886	109.24000000	4.69354730	1.67183832
2013M04	115.24070841	102.87545455	4.63351908	2.18827112
2013M05	114.44250437	103.02695652	4.63499067	0.43687269
2013M06	117.33599401	103.11000000	4.63579638	4.78977054
2013M07	117.53554502	107.71608696	4.67949894	4.24858001
2013M08	113.84385133	110.96454545	4.70921074	1.41220352
2013M09	119.73060614	111.62142857	4.71511304	6.45385211
2013M10	117.03666750	109.47869565	4.69572997	3.11713549
2013M11	118.93240210	108.07619048	4.68283645	4.72393539
2013M12	118.13419805	110.63363636	4.70622417	6.09413950
2014M01	121.42678972	107.57043478	4.67814584	7.24028342
2014M02	120.62858568	108.81200000	4.68962162	4.82940094
2014M03	118.93240210	107.40571429	4.67661339	3.93549504
2014M04	120.12970816	107.87545455	4.68097736	4.15490029
2014M05	118.43352457	109.67590909	4.69752974	3.42792775
2014M06	119.53105513	111.86809524	4.71732046	1.85346502
2014M07	122.52432028	106.98260870	4.67266629	4.15687445
2014M08	118.23397356	101.92238095	4.62421155	3.78377037
2014M09	123.02319780	97.33636364	4.57817265	2.71286674
2014M10	120.02993265	87.26956522	4.46900178	2.52538673
2014M11	120.22948366	78.43800000	4.36230850	1.08469983
2014M12	120.92791220	62.16304348	4.12976067	2.33733512

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2015M01	119.83038164	48.41681818	3.87984724	-1.32342709
2015M02	121.52656523	57.93050000	4.05924402	0.74165977
2015M03	124.32027937	55.79136364	4.02161908	4.43058517
2015M04	124.42005488	59.38954545	4.08411821	3.50913198
2015M05	121.02768770	64.56142857	4.16761715	2.16675143
2015M06	124.71938139	62.34590909	4.13269806	4.24900516
2015M07	122.62409578	55.86565217	4.02294974	0.08140009
2015M08	125.41780993	46.99428571	3.85002601	5.89851550
2015M09	125.71713644	47.23454545	3.85512552	2.16614968
2015M10	125.11848341	48.12409091	3.87378290	4.15200052
2015M11	124.71938139	44.41714286	3.79362550	3.66639844
2015M12	126.21601397	37.72173913	3.63023656	4.28002345
2016M01	126.61511599	30.80333333	3.42762291	5.50746456
2016M02	128.01197306	33.19809524	3.50249250	5.19909163
2016M03	127.21376902	39.07086957	3.66537717	2.30077582
2016M04	125.31803442	42.24714286	3.74353673	0.71914013
2016M05	127.31354452	47.13272727	3.85296761	5.06335550
2016M06	126.51534048	48.47818182	3.88111384	1.42973047
2016M07	117.43576952	45.07095238	3.80823797	-4.32320023
2016M08	128.01197306	46.14434783	3.83177448	2.04731560
2016M09	123.02319780	46.18863636	3.83273380	-2.16614968
2016M10	127.71264655	49.73238095	3.90665625	2.05216357
2016M11	127.91219756	46.43590909	3.83807306	2.52778072
2016M12	127.71264655	54.06545455	3.99019543	1.17879558
2017M01	129.70815665	54.89272727	4.00538087	2.41350757
2017M02	129.20927912	55.49350000	4.01626590	0.93096095

Year	Industrial production index	Oil price	Logarithm of oil price	Annual growth rate of industrial production index
2017M03	131.10501372	51.96826087	3.95063316	3.01297415
2017M04	133.99850337	53.06350000	3.97148931	6.69738495
2017M05	132.00299327	50.87086957	3.92929045	3.61717002
2017M06	131.80344225	46.89454545	3.84790137	4.09481695

APPENDIX II

Some eviews output

Figure 1: Estimation Window

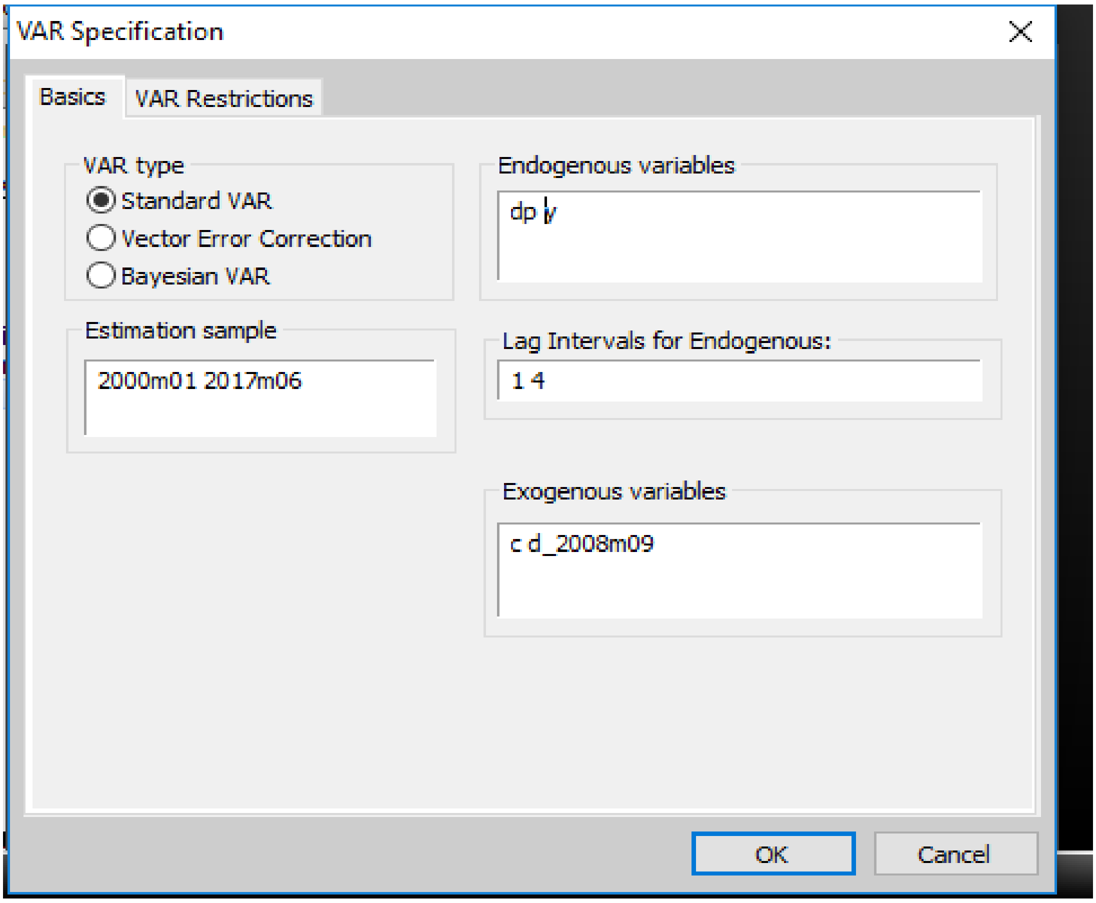

Table 1: Eviews output for the Unrestricted VAR

Vector Autoregression Estimates
Date: 28/10/18 Time: 22:26
Sample (adjusted): 2001M05 2017M06
Included observations: 194 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DP	DYA
DP(-1)	0.256551	3.896297
	(0.07482)	(2.76845)
	[3.42912]	[1.40740]
DP(-2)	-0.004217	-1.472166
	(0.07640)	(2.82723)
	[-0.05519]	[-0.52071]
DP(-3)	-0.029373	5.013956
	(0.07614)	(2.81743)
	[-0.38579]	[1.77962]
DP(-4)	-0.062302	0.601152
	(0.07464)	(2.76209)
	[-0.83467]	[0.21764]
Y(-1)	0.002115	0.809242
	(0.00202)	(0.07478)
	[1.04662]	[10.8215]
Y(-2)	0.000734	0.149039
	(0.00257)	(0.09519)
	[0.28538]	[1.56575]
Y(-3)	-0.003116	-0.041889
	(0.00257)	(0.09519)
	[-1.21109]	[-0.44004]
Y(-4)	0.000498	-0.091988
	(0.00198)	(0.07333)
	[0.25118]	[-1.25450]
C	0.002974	0.944853
	(0.00923)	(0.34159)
	[0.32216]	[2.76604]
D_2008M09	-0.018954	-1.619981
	(0.02847)	(1.05346)
	[-0.66577]	[-1.53777]
R-squared	0.102472	0.827743
Adj. R-squared	0.058572	0.819317
F-statistic	2.334179	98.24132
Log likelihood	203.9705	-496.5670
Akaike AIC	-1.999696	5.222340
Schwarz SC	-1.831249	5.390786
Mean dependent	0.003130	4.463330
S.D. dependent	0.089484	7.558351

Table 2: Serial Correlation (LM) Test for the Unrestricted VAR

VAR Residual Serial Correlation LM Tests
Date: 06/01/19 Time: 17:03
Sample: 2000M01 2017M06
Included observations: 194

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	4.778376	4	0.3108	1.199179	(4, 362.0)	0.3108
2	3.336701	4	0.5031	0.835712	(4, 362.0)	0.5031
3	5.620604	4	0.2293	1.412185	(4, 362.0)	0.2293
4	3.044917	4	0.5503	0.762325	(4, 362.0)	0.5503
5	2.882799	4	0.5776	0.721576	(4, 362.0)	0.5776
6	8.341879	4	0.0798	2.103805	(4, 362.0)	0.0798
7	1.473641	4	0.8313	0.368142	(4, 362.0)	0.8313
8	4.478205	4	0.3451	1.123382	(4, 362.0)	0.3451
9	8.636476	4	0.0709	2.178990	(4, 362.0)	0.0709

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	4.778376	4	0.3108	1.199179	(4, 362.0)	0.3108
2	9.175245	8	0.3277	1.151952	(8, 358.0)	0.3278
3	13.22537	12	0.3529	1.107030	(12, 354.0)	0.3530
4	17.89438	16	0.3301	1.124414	(16, 350.0)	0.3303
5	20.94850	20	0.4002	1.051593	(20, 346.0)	0.4005
6	33.38416	24	0.0962	1.413444	(24, 342.0)	0.0965
7	41.34149	28	0.0500	1.508915	(28, 338.0)	0.0502
8	42.60004	32	0.0997	1.355053	(32, 334.0)	0.1003
9	48.04663	36	0.0864	1.361315	(36, 330.0)	0.0872

*Edgeworth expansion corrected likelihood ratio statistic.

Table 3: Heteroscedasticity Test for the Unrestricted VAR

VAR Residual Heteroskedasticity Tests (Levels and Squares)

Date: 06/01/19 Time: 17:08

Sample: 2000M01 2017M06

Included observations: 194

Joint test:

Chi-sq	df	Prob.
88.98647	51	0.0008

Individual components:

Dependent	R-squared	F(17,176)	Prob.	Chi-sq(17)	Prob.
res1*res1	0.278240	3.991077	0.0000	53.97853	0.0000
res2*res2	0.075630	0.847062	0.6370	14.67232	0.6191
res2*res1	0.102264	1.179335	0.2856	19.83919	0.2825

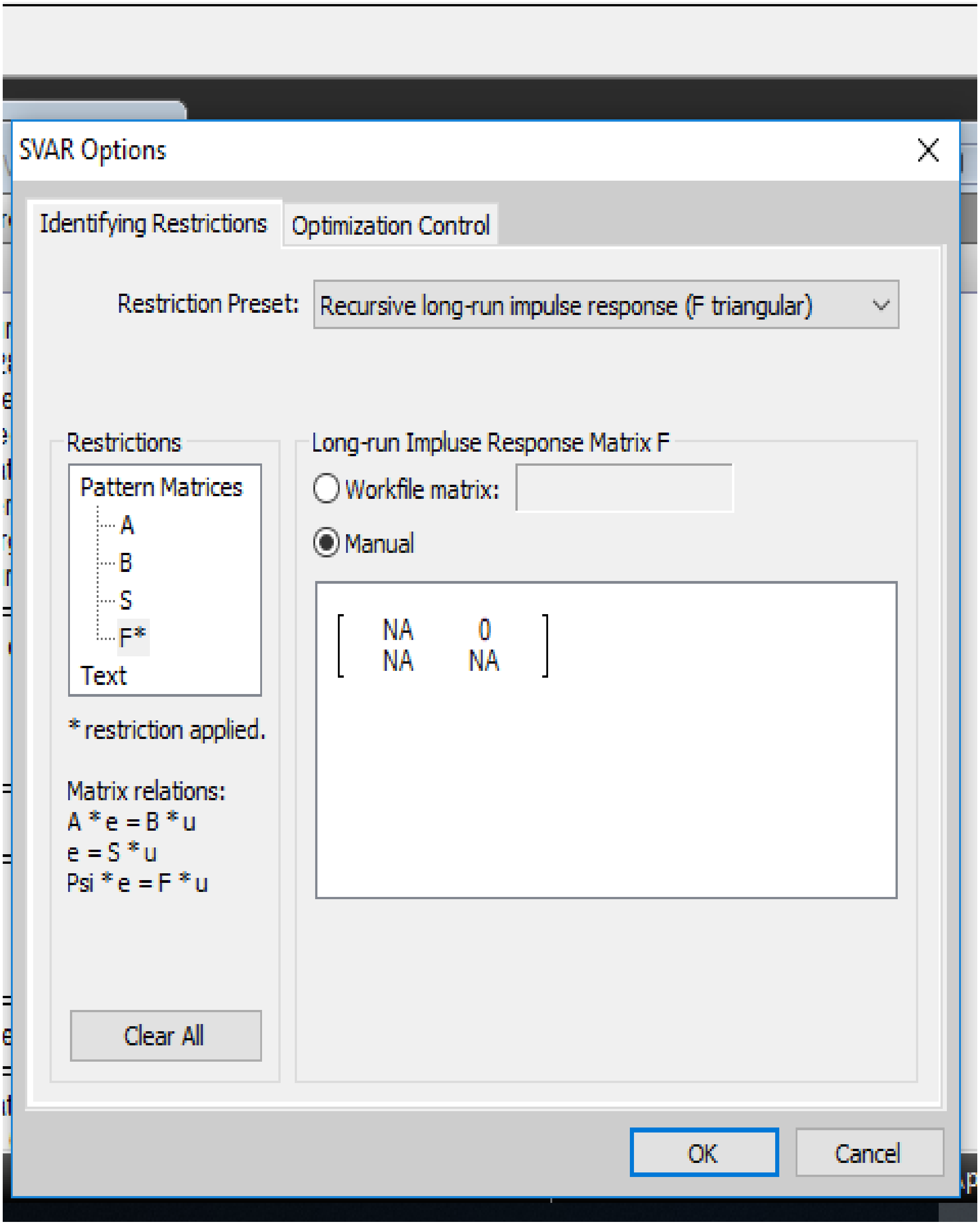

Figure 2: Eviews window for imposing long run restriction (BQD)

Table 4: Eviews Output after the Long run Restrictions

Model: e = Phi*Fu where E[uu']=I

F =

C(1)	0
C(2)	C(3)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.105796	0.005371	19.69771	0.0000
C(2)	8.962667	1.358370	6.598105	0.0000
C(3)	17.82689	0.905023	19.69771	0.0000

Log likelihood -299.7190

Estimated S matrix:

0.086726	-0.004124
0.723289	3.130336

Estimated F matrix:

0.105796	0.000000
8.962667	17.82689

Table 5: Variance Decomposition of ΔP:

Period	S.E.	Shock1	Shock2
1	0.086693	96.75165	3.248348
2	0.090249	96.89873	3.101265
3	0.091225	96.06327	3.936731
4	0.091231	96.05290	3.947104
5	0.091396	95.96474	4.035262
6	0.091405	95.96210	4.037900
7	0.091408	95.96181	4.038193
8	0.091408	95.96171	4.038295
9	0.091410	95.96159	4.038414
10	0.091410	95.96160	4.038395
11	0.091410	95.96161	4.038393
12	0.091410	95.96161	4.038394
13	0.091410	95.96161	4.038393
14	0.091410	95.96160	4.038397
15	0.091410	95.96160	4.038401
16	0.091410	95.96160	4.038404
17	0.091410	95.96159	4.038407
18	0.091410	95.96159	4.038408
19	0.091410	95.96159	4.038410
20	0.091410	95.96159	4.038410
21	0.091410	95.96159	4.038411
22	0.091410	95.96159	4.038411
23	0.091410	95.96159	4.038411
24	0.091410	95.96159	4.038412
25	0.091410	95.96159	4.038412
26	0.091410	95.96159	4.038412
27	0.091410	95.96159	4.038412
28	0.091410	95.96159	4.038412
29	0.091410	95.96159	4.038412
30	0.091410	95.96159	4.038412
31	0.091410	95.96159	4.038412
32	0.091410	95.96159	4.038412
33	0.091410	95.96159	4.038412
34	0.091410	95.96159	4.038412
35	0.091410	95.96159	4.038412
36	0.091410	95.96159	4.038412
37	0.091410	95.96159	4.038412
38	0.091410	95.96159	4.038412
39	0.091410	95.96159	4.038412
40	0.091410	95.96159	4.038412

Table 6: Variance Decomposition of Y

Period	S.E.	Shock1	Shock2
1	3.224639	12.74289	87.25711
2	4.242746	16.97132	83.02868
3	5.073741	17.89254	82.10746
4	5.783869	21.64090	78.35910
5	6.287503	24.34922	75.65078
6	6.668135	26.16912	73.83088
7	6.936487	27.46813	72.53187
8	7.120721	28.23481	71.76519
9	7.247681	28.73481	71.26519
10	7.333601	29.06218	70.93782
11	7.392037	29.27806	70.72194
12	7.431665	29.42595	70.57405
13	7.458445	29.52568	70.47432
14	7.476535	29.59317	70.40683
15	7.488711	29.63866	70.36134
16	7.496896	29.66914	70.33086
17	7.502391	29.68960	70.31040
18	7.506076	29.70331	70.29669
19	7.508547	29.71250	70.28750
20	7.510203	29.71866	70.28134
21	7.511313	29.72279	70.27721
22	7.512056	29.72555	70.27445
23	7.512553	29.72741	70.27259
24	7.512886	29.72865	70.27135
25	7.513109	29.72948	70.27052
26	7.513258	29.73003	70.26997
27	7.513358	29.73041	70.26959
28	7.513425	29.73065	70.26935
29	7.513470	29.73082	70.26918
30	7.513500	29.73093	70.26907
31	7.513520	29.73101	70.26899
32	7.513533	29.73106	70.26894
33	7.513542	29.73109	70.26891
34	7.513548	29.73111	70.26889
35	7.513552	29.73113	70.26887
36	7.513555	29.73114	70.26886
37	7.513557	29.73114	70.26886
38	7.513558	29.73115	70.26885
39	7.513559	29.73115	70.26885
40	7.513559	29.73115	70.26885

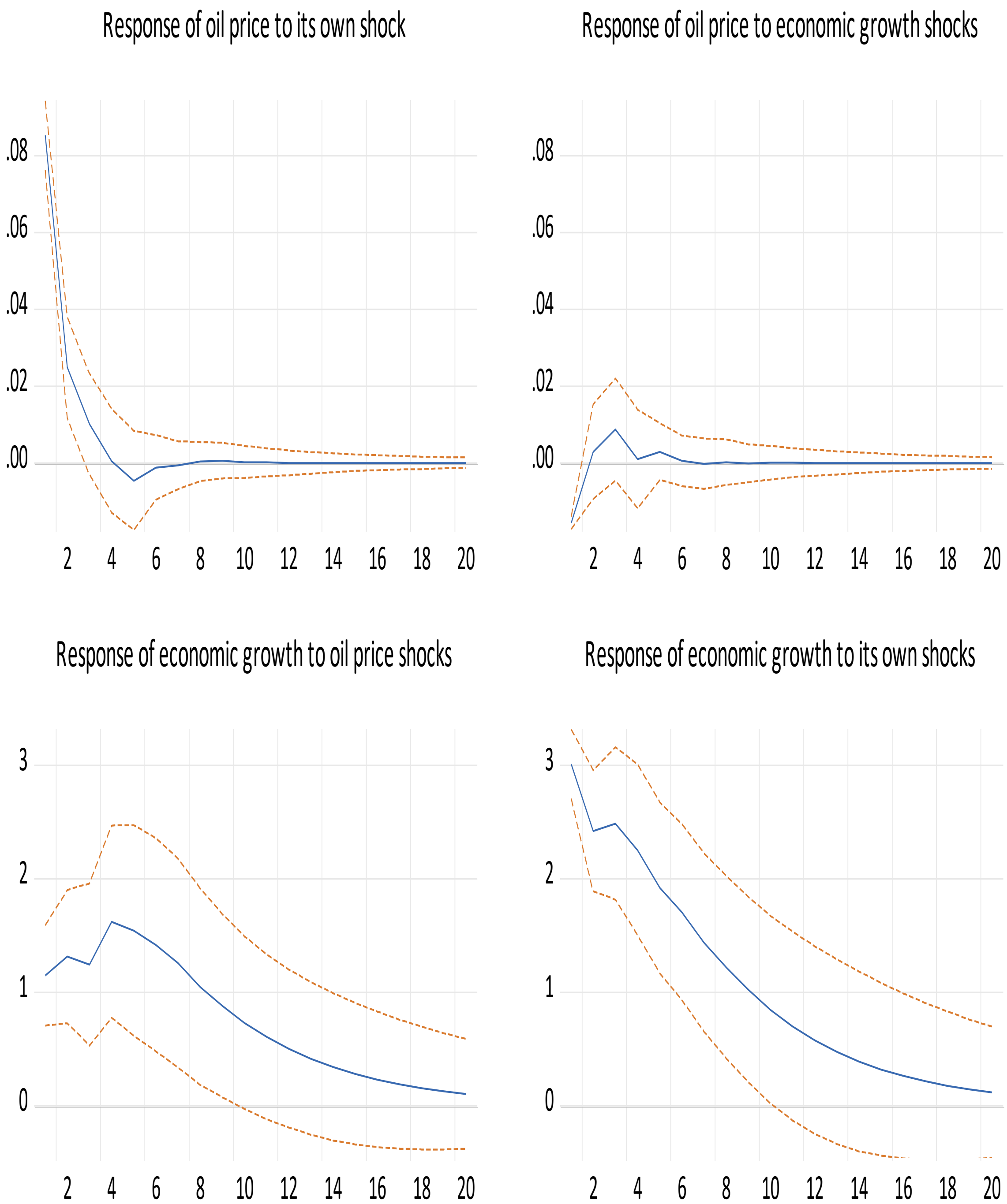

Figure 3: Transitory impulse response

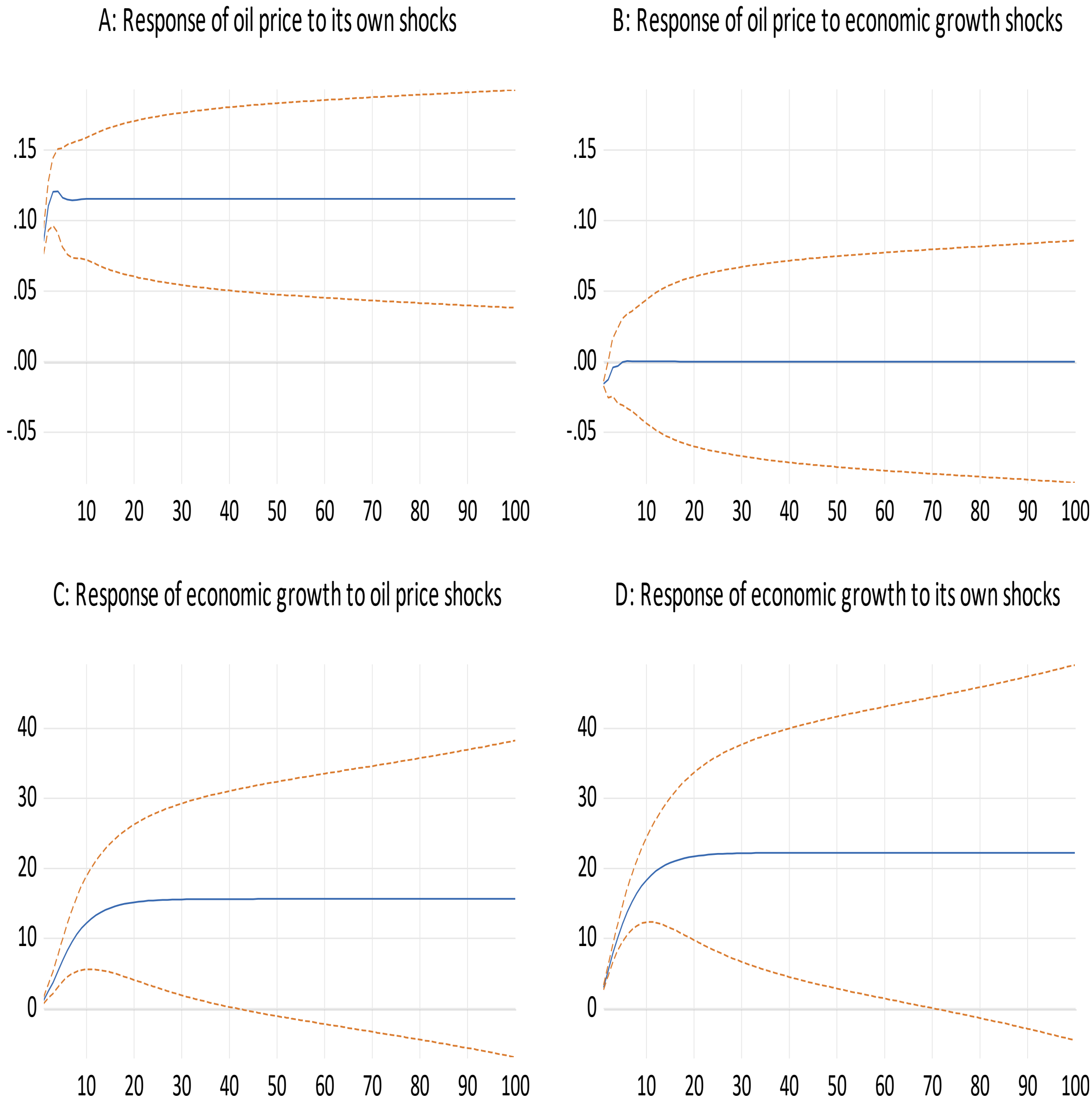

Figure 4: Accumulated impulse response

Table 7: Unit Root Test

ADF AT LEVEL					
Variable	Deterministic Trend	Test Value	5% Critical Value	Prob	Decision
ΔY	C	-3.162468	-2.876047	0.0238	I(0)
ΔY	C&T	-3.178388	-3.432799	0.0918	I(1)
ΔY	N	-2.705350	-1.942448	0.0069	I(0)
lp	C	-1.784472	-2.875262	0.3875	I(1)
lp	C&T	-1.519314	-3.431576	0.8201	I(1)
lp	N	0.055086	-1.942361	0.6993	I(1)
ADF AT FIRST DIFFERENCE					
ΔY	C	-15.10933	-2.876123	0.0000	I(0)
ΔY	C&T	-15.07455	-3.432917	0.0000	I(1)
ΔY	N	-15.14712	-1.942456	0.0000	I(0)
lp	C	-11.49593	-2.875262	0.0000	I(1)
lp	C&T	-11.53344	-3.431576	0.0000	I(1)
lp	N	-11.51852	-1.942361	0.0000	I(1)
PP AT LEVEL					
ΔY	C	-3.162468	-2.876047	0.0238	I(0)
ΔY	C&T	-3.178388	-3.432799	0.0918	I(1)
ΔY	N	-2.651460	-1.942448	0.0081	I(0)
lp	C	-1.794580	-2.875195	0.3825	I(1)
lp	C&T	-1.385814	-3.431471	0.8625	I(1)
lp	N	0.167979	-1.942353	0.7340	I(1)
PP AT FIRST DIFFERENCE					
ΔY	C	-15.10239	-2.876123	0.0000	I(0)
ΔY	C&T	-15.06949	-3.432917	0.0000	I(0)
ΔY	N	-15.13946	-1.942456	0.0000	I(0)
lp	C	-11.49453	-2.875262	0.0000	I(1)
lp	C&T	-11.52250	-3.431576	0.0000	I(1)
lp	N	-11.51842	-1.942361	0.0000	I(1)

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ETHICS COMMITEE APPROVAL

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

30.11.2018

Dear Mustafa Halgurd Hamadamın

Your application titled **"Impact Of Oıl Prıce Shocks On Turkey's Economıc Actıvıty"** with the application number YDÜ/SB/2018/310 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.