MACROECONOMIC IMPACTS OF OIL PRICE SHOCKS: AN EMPIRICAL ANALYSIS BASED ON THE SVAR MODELS

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Abstract
Since oil is a major source of energy, many sectors of the economy are directly or indirectly dependent on oil. Therefore, oil price shocks have many important effects on the global economy. The aim of this paper is to investigate the effects of oil price shocks on key macroeconomic variables of the Turkey by using SVAR analysis for the period from 2005Q1 to 2017Q2. Our empirical evidence confirmed that the increase in the price of crude oil in Turkey leads to a decrease in economic growth while increasing crude oil prices, inflation and real exchange rate.

Keywords: Oil prices; Inflation; Exchange Rate; Real GDP, SVAR Models.
JEL Classification: C32; E30; F41

1. Introduction

Crude oil, one of the cornerstones of economic development, is the most important raw material and the main energy source in the world. Oil has an important role in every part of the economy, namely in transportation, energy and industrial sectors (Nazir and Hameed, 2015, p.1). Thus, oil is needed to produce electricity, to operate production machines and to transport products to the market (Rafiq et al., 2009, p.121).

There is a geographically unbalanced distribution of energy resources on Earth. Therefore, the rise in oil prices brings about different results on the economic performance and stability of oil exporting and oil importing countries. For example, the impact felt by oil importing countries may differ from those of oil exporting countries. Countries exporting oil may benefit from these increases, as oil importing countries tend to be in an economic downturn due to rising oil prices (Sek, 2017, p.204).

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An increase in oil prices or a fall in oil prices that can affect macroeconomic variables can be defined as an oil price shock (Jiranyakul, 2016, p.193). The shock in oil prices not only greatly affects economic activity but also increases economic policy uncertainty (Lee et al., 2017, p.571). Shock transmission and an understanding of the relationship between oil price changes and economic responses provides useful information to policy makers. Thus, more preventive measure / measures are taken to reduce the negative effects of oil price shocks.

The impact of oil price shocks on the economy is determined not only by oil prices, but also by the response of monetary policy measures to oil price shocks (Cunado et al., 2015, p.868). For example, with the policy changes made by central banks in order to achieve a low and stable inflation rate in response to the increase in oil prices, the simultaneous effects of this increase on production and inflation can be reduced.

The direct impact of a certain increase in oil prices on importer countries is loss of income. This loss in income depends on the oil concentration in the production and the price elasticity of the oil demand.
If consumers do not want to reduce oil consumption in response to the increase in oil prices, they could potentially slow GDP growth by reducing their spending on other goods and services (Ghalayini, 2011, p.132). In addition, due to the increase in oil prices, importing countries' domestic foreign exchange demand increases and therefore there is an upward pressure on exchange rates. With the rise of exchange rate, the value of country assets of oil importing countries falls. In addition, as oil contracts are made in US dollars, the increase in exchange rate increases the need for US dollar based international reserves (Yılmaz and Altay, 2016, p.657).

Achieving economic stability in the face of global competition has become indispensable for policy makers, especially in developing countries. It is estimated that the dependence of developing countries on oil will increase in the coming years. For this reason, it is extremely important to determine how the volatility of oil prices affects the economic activities of these countries (Rafiq et al., 2009, p.123).

The studies examining the changes in oil prices are mostly directed at developed countries. Studies that analyze the impact of oil price shocks are more needed for developing countries. In this study, it is aimed to analyze the effect of oil price shock on different macroeconomic variables such as economic growth, inflation and real exchange rate in Turkey. Turkey is an

emerging market economy that is largely dependent on crude oil imports, and for this reason the economy is very sensitive to changes in oil prices.

The rest of the paper is organized as follows. Section 2 briefly reviews the relevant literature concerning the effect of oil price shocks. Section 3 summarizes the applied literature. Section 4 introduces the data source variable definitions and econometric methodology. Section 5 discusses the empirical results. Finally, Section 6 reviews our conclusions and policy implications.

2. Theoretical Framework

A shock in the price of oil affects different macroeconomic variables (such as economic growth, inflation and exchange rate) in the economy. Oil prices affect the real economy with a transmission mechanism that includes both demand and supply channels.

Supply side effects are related to the cost of production of the firm. For example, an increase in the price of oil raises production costs; because crude oil is used as a key intermediate input in the production function (Gbatu et. al., 2017, p.3; Basnet and Upadhyaya, 2015, p.3079; Ghalayini, 2011, p.128).This is even more important for commodities produced with petroleum products. The increase in the price of oil also increases the costs of distribution of the products of the companies with the increase of the transportation costs. In addition, oil prices indirectly affect heating and manufacturing costs. The increase in production costs leads to a decrease in production and consequently a decrease in total supply to the economy (Basnet and Upadhyaya, 2015, p.3079).

The demand side effect of a change in oil prices is due to consumption and investment. Fluctuations in oil prices directly affect household consumption and spending (Ghalayini, 2011, p.128; Basnet and Upadhyaya, 2015, p.3079). The high oil price causes an increase in the general price level, which increases the cost of production and increases the final goods price. This reduces real income and the demand for consumption (Gbatu et. al., 2017, p.3). Moreover, since the price elasticity of oil demand is generally low, high oil prices may force households to reduce their spending on other goods and services, which may lead to a decrease in demand for these goods and services (Basnet and Upadhyaya, 2015, p.3079). This can reduce economic growth.

At the same time, the investment demand is reduced because the high production cost reduces the rate of return on investment. In addition, an increase in future price uncertainties, which is a result of fluctuations in oil prices, may also cause a decrease in investment demand (Gbatu et. al. 2017, p.3).An increase in the prices of oil negatively affects production by reducing investment.

The increase in oil prices worsens the terms of trade of oil importing countries. For this reason, wealth is transferred from the oil importing countries to the oil exporting countries and the purchasing power of firms and households in the oil importer countries (Gbatu et. al., 2017, p.3; Iwayemi and Fowowe, 2011, p.603; Lardic and Mignon, 2006, p.3910).This negatively affects economic growth by reducing households' demand for goods and services. It is expected that these increases in oil prices will increase the foreign exchange earnings and cause an increase in domestic demandin the oil exporting countries. However, it has been suggested that the slowdown in global demand would weaken the benefits provided to oil exporting countries (Iwayemi and Fowowe, 2011:604).For oil exporting countries, the increase in oil prices will directly increase the actual national income through higher export earnings, but a certain portion of this gain is usually offset by losses due to lower export demand due to the economic stagnation experienced by trading partners (Ghalayini, 2011,p.131).

The increase in the price of oil causes the production costs and import bills to rise by increasing input costs; causes the decrease in production, consumption and investment and and thus causes the decrease of economic growth (Nazir and Hameed, 2015,p.1).

Another variable that oil price change can affect is inflation. The rise in oil prices will cause inflation to rise, pulling up production costs and to fallproduction and expected earnings (Lee et al. 2017: 572).As oil prices move up or down, inflation is moving in the same direction (Anandan et al, 2013, 159; Basnet ve Upadhyaya, 2015,p.3079).

As a result of the increase in oil prices, consumers expect either this increase to be temporary or short-term effects on production will be more than long-term effects. In this case, the consumers try to flatten their consumption (keeping their consumption constant) by saving less, or to borrow more. This leads to a rise in equilibrium real interest rates.

The increase in the real interest rate and the slowdown in the increase in output decrease the demand for real money and increase *the inflation rate*.

In short, it can be said that rising oil prices have reduced economic growth and, in addition, increased real interest rates and inflation rates (Brown and Yucel, 2002,p.195)

The rise in oil prices not only affects economic growth and inflation, but also affects *exchange rates*. The rise in oil prices, as well as economic growth, also influences exchange rates mainly through a two-way transition mechanism involving supply and demand channels. On the supply side, as oil is a fundamental factor of production, increases in oil prices are negatively affect production. The price increase in a production factor leads to an increase in the cost of production of non-trade goods. The final result is the appreciation of the exchange rate resulting from the increase in the prices of non-trade goods. On the demand side, the exchange rate is indirectly affected by its relationship to disposable income. The increase in oil prices reduces spending power of consumers. This will reduce the demand for non-trade products and lead to a decrease in the prices of non-trade products and ultimately to the depreciation of the exchange rate (Kin and Courage, 2014, p.194).

The increase in the price of oil leads to the appreciation of the currency of an oil exporting country with the increase of foreign exchange demand in the foreign exchange market. And conversely, the increase in the price of oil causes to depreciate the currency of the oil importing country (Basnet and Upadhyaya, 2015, p.3079). In addition, petroleum contracts are made in US dollars, and as oil exporters invest some of their gains on US dollar denominated assetsrising oil prices will cause the US dollar to appreciate by increasing transaction demand. The increase in the value of the dollar also increases the external debt of the developing countries that import oil. Because this debt is usually dollar-denominated and increases the severity of economic damage caused by high oil prices (Ghalayini, 2011, p.133).

3. Applied Literature

The first study examining the potential effects of changes in oil prices on economic variables was made by Hamilton (1983). Hamilton (1983) analyzes the relationship between oil price and US economic growth during the period 1948-1981. Hamilton (1983) has been reached the conclusion that the rise in the price of crude oil led to a decline in economic growth in the period between the Second World War and 1973 and after 1972, recession in the US was mainly driven by OPEC's supply-side approach. In other words,

oil price shocks are a contributing factor to the US recession. Since then, a number of studies have been conducted that examine the relationship between oil prices and economic activity by researchers.

There are two types of findings related to the studies that examine the relation between oil prices and economic growth.(a) Oil price shocks generally has a negative effect on economic growth and (b) the price of oil does not have to be linear. Last finding (b) suggests that oil prices tend to affect countries differently, depending on the development stage (Narayan et al. 2014: 137). In addition, different economic conditions may mitigate or strengthen the effects of oil price shocks (Lee et al, 2017, p.572). At the same time, there are also studies that suggest that there is an asymmetry between these variables. Mork (1989) found that the effects of the increase in oil prices were different from the effects of decreases in oil prices. Accordingly, increases in oil prices lead to low output, but declines in oil prices do not cause a high output increase (Iwayemi and Fowowe, 2011, p.603).Some of the studies on the relationship between oil prices and economic growth are as follows:

Nazir and Hameed (2015), used the data in the Pakistan for 1972-2011 and Johansen cointegration test. They concludes that oil prices impacting real GDP negatively in long run but positively in short run. Yardımcıoğlu and Gülmez (2013) applied Panel Cointegration and Panel Granger Causalityfor 10 OPEC countries from 19710 to 2011. They show that long run bilateral causality between oil price and economic growth. Ghalayini (2011) investigated the interaction between oil price changes and economic growth in the case OPEC countries, Russia, China, India from 2000 to 2010 using Granger Causality test. The researcher conclude that the interaction between oil price changes and economic growth is not proved for the most countries but for the G-7 group where, a unidirectional relation from oil price to gross domestic product is proven in the G-7 countries. Iwayemi and Fowowe (2011) found that positive oil shocks have not caused GDP and negative oil shocks significantly cause output and the real exchange rate in the Nigeria for the period 1985- 2007 using VAR model. Tang et al (2010), used data of China from 1998 to 2008. The researcher reported that an oil-price increase negatively affects output and investment. Lardic and Mignon (2006) concludes that the relationship between oil price and economic activities is asymmetric; that is, rising oil prices retard aggregate economic activity more than falling oil prices stimulate itin the 12 European countries 1970- 2003

using Johansen cointegration test. Jimenez-Rodriguez and Sanchez (2005) investigated industrialised OECD countries (individual G-7 countries, Norway and the euro area as a whole) for the time period 1972-2001using multivariate VAR analysis. The researcher show that evidence of a non-linear impact of oil prices on real GDP is found.

In addition, contrary to literature, there are also studies that conclude that there is a positive relationship between oil prices and economic growth. Some of these studies are: Mendoza and Vera (2010) showed a significantpositive effect of oil price shocks on economic growthusing GARCH model during the period 1984 to 2008 in the case of Venezuela. Farzanegan and Markwardt (2009), find a strong positive relationship between positive oil price changes and industrial output growth in the Iranian economy by applying a VAR approach for the 1975:II–2006:IV period. In these studies, the reason for the positive relationship between oil prices and economic growth is the fact that the countries involved in the analysis are the oil exporting countries. And also, Prasad et al (2007) found that an increase in oil has a positive, albeit inelastic, impact on real GDP, inconsistent with the bulk of the literature for a small island economy and an oil-importing country, Fiji, during the period 1970-2005 using FMOLS, ARDL and OLS. Because Fiji's actual output has not reached a threshold level.

In a large number of studies it is stated that oil is a significant influence in determining consumer price inflation because oil is directly input for many consumer goods (Sek et al., 2015, p.631). Some of the studies on the relationship between oil prices and inflation are as follows: Sek (2017) investigated Malaysian economy for the time period 1980-2015 using ARDL modeling. The researcher confirmed that changes in oil prices led to an increase in production, but the direct effect on long-term consumer prices was limited. Salisu et al. (2017) applied panel data analysis for net oil exporting (five countries) and net oil importing countries (ten countries) from 2000 to 2014 and the study results show that a significant long-run positive relationship between oil price and inflation. Also, in the long run, oil price exerts a greater impact on inflation of net oil importing countries than their oil exporting counterparts. Jiranyakul (2016) evaluated Tayland data from 1993 to 2015 Johansen cointegration test and Granger causality test and the study imply that an oil price shock causes inflation to increase while oil price uncertainty does not cause an increase in inflation. Çatık and Önder (2013) applied Markov Regime switching model for Turkey over the period 1996-

2007 and the study indicate that there is evidence of asymmetric oil pass-through effect. Castillo et al. (2010) in US case, averages levels of both oil price and inflation for the three sub-samples, 1970-1983, 1984-2002 and 2002-2008 find that an increase in oil price volatility may lead to a higher inflation level. Jacquinot et al. (2009) concludes that oil price changes is a vital factor for estimating inflation in the short-run in the Euro area using DSGE model. Cologni and Manera (2008) applied vector-autoregreassive (VAR) framework and impulse response function analysis over the period 1980–2003 using the data of G-7 countries. They have found that oil prices affect inflation but this effect is temporary. Bermingham (2008) using Engle-Granger method ve ARDL method in Ireland case during the period 1996-2008 and finds the impact of increasing oil price on inflation. Hooker (2002) divides his study period (1962-2000) as before 1980 and post-1980 in the US. He finds a significant impact of oil price on inflation in the before 1980 but not in the post 1980 using regression analysis. Berument and Tasci (2002) find that a significant effect of oil price on inflation when the general price level is adjusted in Turkey case for 1990 using input-output table.

As oil prices are determined in US dollars, a change in oil prices also affects the exchange rate. The increase in oil prices is usually caused by the depreciation of the dollar in oil importing countries and the appreciation of oil exporting countries. Some of the studies on the relationship between oil prices and exchange rates are: Mensah et al. (2017) implied that evidence of a growing inverse relationship between oil price and exchange rate, especially in the post crisis period, in the six oil-dependent economies over the periods 2000-2007 and 2010-2016 using Johansen Cointegration tests. Volkov and Yuhn (2016) found that the volatility of exchange rate associated with an oil price shock is significant in emerging markets (Russia, Brazil, and Mexico), but weak in advanced markets (Norway and Canada) for 1998-2012 using GARCH-M, VECM and Toda and Yamamoto tests. Bayat et al. (2015) in the Czech Republic (for 1997-2011), Poland (for 2000-2011) and Hungary (for 2001-2011) using Toda-Yamamoto and causality tests found that oil price fluctuations affect real exchange rates in the long run in Poland and Czech Republic and do not affect exchange rate in any period in Hungary. Kin and Courage (2014) investigated that oil prices have a significant impact on nominal exchange rates. In addition, the findings reveal that an increase in oil prices leads to a depreciation of the rand exchange rate in South Africa, for the time period 1994-2012 using GARCH test. Brahmasrene et al. (2014)

concludes that the exchange rates Granger-caused crude oil prices in the short run while the crude oil prices Granger-caused the exchange rates in the long run in the US for 1996-2009 using Granger causality test, and variance decomposition and impulse response function analysis. Şahbaz et al. (2013), concludes that time domain causality analysis indicates causality running from real oil price to real exchange rate, while frequency domain causality analysis implies reverse causality in all time frequencies using time domain causality test (developed by Hatemi-J) and frequency domain causality (developed by Candelon and Breitung) approaches imply different results in the Romania for the period 2004- 2011. Adeniyi vd. (2012), concludes that the increase in the price of oil has resulted in an increase in the exchange rate over the period 2009-2010 in the Nigeria using GARCH/EGARCH Models. Ghosh (2011) found that the increase in the price of oil causes the depreciation of the Indian currency for the time period 2007-2008 in the India case using GARCH/EGARCH Models. Lizardo and Mollick (2010) imply that an increase in real oil prices leads to a significant depreciation of the U.S. dollar in the developed net oil-producing countries in the 17 oil exporting countries for the period 1970- 2008 using VAR model. Korhonen and Juurikkala (2009) found that the price of oil statistically significant effect on real exchange rates and higher oil price lead to appreciation of the real exchange rate in the nine oil-producing OPEC countries for the timeperiod 1975-2005 using panel data analysis. Chen and Chen (2007) found that real oil prices may have been the dominant source of real exchange rate movements and that there is a cointegrating relationship between real oil prices and real exchange rates in the G7 countries for the period 1972-2005 using panel data analysis. Dawson (2007) found that the increase in oil prices leads to the depreciation of the peso for 1991-2005 in the Dominican Republic using Multivariate Regression Model and Cointegration test. Zalduendo (2006) concludes that oil prices have played a importanat role in determining real exchange rate and the increase in the price of oil increases the exchange rate in the Venezuela for the time period 1950-2004 using VEC Model. Chaudhuri and Daniel (1998) show that the direction of causality runs from real oil prices to real exchange rates over the period 1973-1996 in the 16 OECD countries using cointegration and causality tests.

4. Data and Methodology

The study uses SVAR model of Turkey over the period 2005Q1-2017Q2, which provides 48 quarterly observation. We use crude oil price, real Gross Domestic Product, Consumer Price Index, and real exchange rate series for our analysis. To standardize the variables, we use the natural logarithm for all variables. The full name, description and source of the data are presented in the Table 1.

Table 1: The Dataset-Variable Description

Variable	Full name	Description	Source
OIL	The Brent Crude Oil Price	UK Brent Crude petroleum in US dollars per barrel	UNCTAD
GDP	Gross Domestic Product	Gross Domestic Product, Deflator, 2003=100	IMF-IFS
CPI	Consumer Price Index	Consumer Price Index, 2003=100	TURKSTAT
REER	Real Exchange Rate	CPI Based Real Effective Exchange Rate, 2003=100	CBRT

In order to estimate the effect of oil price change (fluctuation) on these macroeconomic variables, we use a structural VAR (SVAR) model which includes oil price (oil) and three macroeconomic variables-economic growth (gdp), inflation (cpi) and the real exchange rate (reer). Thus the SVAR model can be written as follows:

$$Bx_t = \Gamma_0 + \sum_{i=1}^{n} \Gamma_i x_{t-i} + \varepsilon_t \qquad (1)$$

where $x_t = (oil, gdp, cpi, reer)$ is a 4×1 vector of endogenous variables, B represents the 4×4 contemporaneous matrix, Γ_0 refers to the vector of constant terms, Γ_i are the 4×4 autoregressive coefficient matrices, n is the optimal lag length. ε_t is a 4×1 vector of serially and mutually uncorrelated structural innovations.

When the elements of B^{-1} are estimated, we can obtain the estimated vector of structural shocks, ε_t, since $e_t = B^{-1}.\varepsilon_t$, as well as the responses of

x_t to each structural shock (Ahmadi, et al., 2016, p.14). Following Kilian (2009) and Kilian and Park (2009), we decompose the error terms implied by reduced-form VAR using the representation $e_t = B^{-1}.\varepsilon_t$, that is (Chen et.al., 2016, p.1041):

$$e_t = \begin{bmatrix} e_t^{oil} \\ e_t^{gdp} \\ e_t^{cpi} \\ e_t^{reer} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{oil\ shock} \\ \varepsilon_t^{gdp\ shock} \\ \varepsilon_t^{cpi\ shock} \\ \varepsilon_t^{reer\ shock} \end{bmatrix} \quad (2)$$

where element 0 in the matrix indicate that there are no expected contemporaneous responses from specific shocks; the nonzero elements a_{ij} (i=1,2, 3,4; j=1,2,3,4) are the coefficients of the i's responses to the shocks j (Chen et al.,2016, p.45).

This scheme follows an order from exogenous to endogenous, related to the respective responses of variables to temporary shocks (Amaiquema and Amaiquema, 2017, p.148). The constraints applied to the system in the SVAR model are based on the theory of economics (Güneş et al. 2013, p.7). Four restrictions according to theory were applied. Oil price does not respond to innovations to the other macroeconomic variables in the period t (Amaiquema and Amaiquema, 2017, p.148). An increase in oil prices can lead to an increase in oil prices, as oil is an important input to both the production and the distribution of goods and services. In addition, since Turkey is a country that imports oil, it does not have the power to influence oil prices. Therefore, oil prices are completely external. The second row of the identification matrix contains economic growth variables. It is assumed that the economic growth variable does not respond simultaneously to any changes in the domestic variables. It is assumed that the inflation variable is affected by all variables except the real exchange rate. There are no restrictions on the real exchange rate. The exchange rate reacts to changes in all variables (Basnet and Upadhyaya, 2015, p.3082).

5. Emprical Results

Macroeconomic time series data are generally nonstationary, and the use of nonstationary data leads to misleading or spurious results. In addition, the premise of using a SVAR model is that all variables are stationary. In order to ensure the stationarity of the data series, Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test. The results obtained regarding ADF and PP Unit Root tests are reported in the Table 2.

Table 2: Unit Root Tests Results

	ADF Unit Root Test		Phillips-PerronUnit Root Test		Order of integration
Variables	Level	1st Difference	Level	1st Difference	
OIL	-2.440460 (-2.923780)	-5.411338 (-2.923780)	-2.171951 (-2.922449)	-5.247297 (-2.923780)	I(1)
GDP	-1.280288 (-2.923780)	-4.704396 (-2.923780)	-1.697873 (-2.922449)	-4.815641 (-2.923780)	I(1)
CPI	-2.088971 (-2.931404)	-6.849778 (-2.926622)	-2.303326 (-2.922449)	-11.52589 (-2.923780)	I(1)
REER	-1.722988 (-2.922449)	-6.558187 (-2.923780)	-1.839954 (-2.922449)	-7.044417 (-2.923780)	I(1)

Note: An intercept is chosen for all the variables in unit root tests. The numbers in the table are t statistic values and critical values are reported in the parentheses.

The null hypothesis of the ADF and PP test states that the variable contains a unit root, that is, the variable is non-stationary while the alternative hypothesis states that the variable is generated by a stationary process, that is, variable is stationary. As seen in the table 2, all the data series are not stationary in the level because they fail to reject the null hypothesis of a unit root at the significance level of 5%. However, all the first differenced variables are stationary.

In diagnostic tests, the model is tested for serial correlation and Heteroskedasticity by using Langrage Multiplier (LM) test and White Heteroskedasticity test. The diagnostic tests results are presented in Table 3.

Table 3: Diagnostic Test Results

Autocorrelation LM Test			White Heteroskedasticity Test	
Lags	LM-Stat	Prob	Chi-sq	404.9869
1	13.03122	0.6705	df	390
2	9.057972	0.9110	Prob.	0.2899
3	19.81835	0.2285		

Autocorrelation LM Test results suggest in non-rejection of the null hypothesis of non-autocorrelation until the 3^{th} lag, that is, there is no serial correlation among the residual. According to White Heteroskedasticity Test, null hypothesis is not rejected in this model. The null hypothesis is the absence of heteroskedasticity in the VAR. In summary The results of diagnostic tests suggest that there is no serial correlation among the residual terms and the functional form of model is also well specified. The lag lengths are determined based on AIC criteria and the lag length are chosen to be 3. The long-term structural VAR model is presented in Table 4.

Table 4: Long Term Multiplier Matrix for SVAR Model

	OIL	GDP	CPI	REER
OIL	0.155006*			
	(0.0000)			
GDP	-0.000721**	0.002505*		
	(0.0558)	(0.0000)		
CPI	0.001698*	-0.000208	0.004330*	
	(0.0105)	(0.7451)	(0.0000)	
REER	0.021641*	0.008246	0.002512	0.035065*
	(0.0002)	(0.1165)	(0.6276)	(0.0000)

Note: *Denote statistical significance at 5% level
**Denote statistical significance at 10% level.

The coefficients obtained in the long-term multiplier matrix are not interpreted. However, the sign and significance of these coefficients are indicative of the effects of shocks. Row values in the long-term multiplier matrix are independent variables, and column values indicate the effects of shocks on variables.

As shown in Table 4, the response of the variables to the crude oil price shocks was found statistically significant. While the response to crude oil prices, inflation and real exchange rate shocks of oil prices was positive, the impact of crude oil price shocks on economic growth was found to be

negative. In other words, the increase in the price of crude oil in Turkey leads to a decrease in economic growth while increasing crude oil prices, inflation and real exchange rate.

So far, we have revealed a framework for analyzing and interpreting the interaction between variables. However, the applied models have not presented anything definite about how the variables react to each other. Impulse-response functions were used to analyze the effects of oil price shocks. With the impulse-response functions, when one-time shock is applied to one of the variables included in the VAR model, the responses for which the other variables show this change can be determined. We perform the Cholesky decomposition on the structural VAR in Equation (2) and investigate the responses of gross domestic product, inflation and real exchange rate to oil price shocks. Figure 1 shows the impulse response functions for the responses of the macroeconomic variables to oil price shocks.

Figure 1: Impulse and Response Results

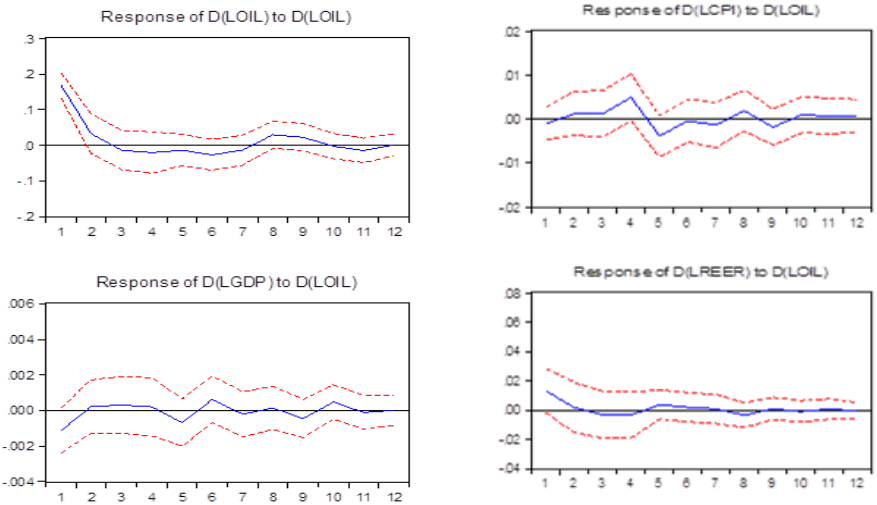

Figure 1 reports the impulse responses of the price of oil itself, economic growth, inflation and real exchange rate for one standard deviation shock to oil prices based on the SVARs as the endogenous variables for a time period of 12 months in Turkey.

When performing an impulse response analysis, the shock applied variable is not only the effect on other variables, but also the effect on itself is taken into account. The crude oil's response to its own shock is positive but this effect is gradually weakening in later periods. The effect of oil price shocks on itself is damped in the 11th period.

The initial response of GDP is the indicator of economic growth to oil price shocks was negative and after fluctuated between positive and negative. The response of GDP to oil price shocks emerges after 1st period. In the 11th period, it appears that the shock's effect is damped. Therefore, the impact of an oil shock on GDP appears in the first period and disappears in the 11th period.

Like GDP, the response of inflation also fluctuated between positive and negative for a time period of 12 months. However, response of inflation to shocks of oil price reached its peak in the fourth period. In the fifth period, the response of inflation to oil shock is at the lowest level. After the fifth period, positive and negative fluctuations have occurred. After the tenth period it appears that the reaction is too small to be neglected.

The response of exchange rate to shock of oil prices is positive at the beginning and this reaction also appears in the first period. There has been little positive and negative fluctuations in the response of the real exchange rate to the price shock of oil prices between the first period and the ninth period. It seems that the reaction of real exchange rate to oil price shock is damped after 9th period.

6.Conclusions

Crude oil is an important source of energy in meeting world energy demand. Since the prices of energy intensive goods and services depend on oil prices, the changes in oil prices have significant effects on both oil exporting countries and oil importing countries. Oil price changes can be influential on determining the economic performances. Oil prices affect the real economy with a transmission mechanism that includes supply and demand channels. An increase in oil prices leads to a decrease in production, consumption and investment and thus to a decrease in economic growth, a rise in the general level of prices and a depreciation of the exchange rate in the oil importing countries.

Although there are a number of studies that separately examine the effects of oil shocks on economic growth, inflation and exchange rate, the

number of studies addressing the impact of oil price shocks on the three macroeconomic variables mentioned is relatively small. Turkey is an emerging market economy that is largely dependent on crude oil imports, and for this reason the economy is quite sensitive to changes in oil prices. In this study empirically examines the impact of oil price shock on economic growth, inflation and exchange rate of the Turkey by using SVAR analysis. SVAR analysis showed that crude oil price shocks positively affected the inflation and real exchange rate variables, together with a negative effect on economic growth.

As a result of these analyzes, it can be said that oil price shocks have an influence on Turkey's macroeconomic indicators. Therefore, in Turkey, a country dependent on oil, policy makers need to take into account risks arising from oil price shocks. Additionally, in order to reduce the adverse effects of increases in oil prices on macroeconomic variables, it is important to reduce energy dependency in production and therefore to use renewable energy sources.

7. References

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