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THE EFFECTS OF OIL PRICE ON TURKISH ECONOMIC GROWTH

Abstract:

Although the oil price is determined by demand and supply, it is also affected by lots of variables such as economic, political and technical conditions. On the other hand, fluctuations in oil price have also effect on macroeconomic stability. Oil price has an important role in Turkey, since Turkey is a country that has external dependency in energy sources. The purpose of this paper is to examine the effects of oil prices on Turkish economic growth. In this respect, the relationship between variables will be analyzed by using annual data between the years 1980-2013. For analyzing variables, it will be used Johansen Cointegration Test, Impulse-Response Function, and Variance Decomposition tests.

Keywords:

Oil price, Economic growth, Turkish Economy

JEL Classification: A10, E00, E21

INTRODUCTION

Oil price, which have always been a controversial matter, is addressed as an important variable in the process of planning economical activities of a country (Kiani, 2011). However, as formation of the oil prices cannot be explained solely by the supply-demand conditions, they have a very volatile structure compared to other commodity prices. Australian Institute of Petroleum (AIP) lists the key factors determining the international oil prices as follows:

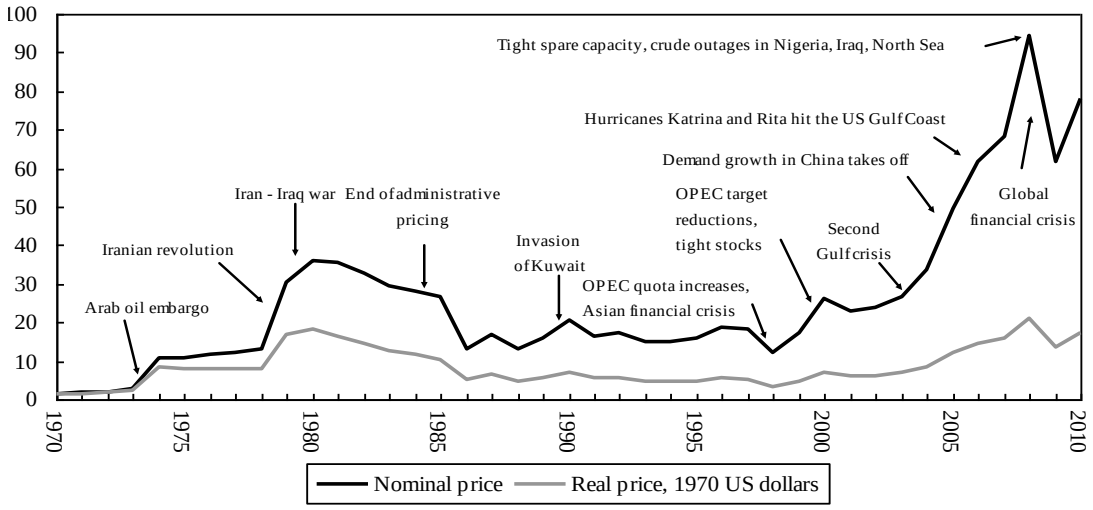
Table 1.Key Factors Influencing International Crude Oil Prices

• Changes in regional and global supply balances in both the short & longer term	• Changes in economic conditions/sentiment in both the short and longer term
• Major supply disruptions from natural disasters, war, civil unrest and strikes	• New oil discoveries
• Seasonal demand and demand spikes	• Investment in new oil production/refining capacity
• Inventory management	• Future global demand and supply balances
• Shipping availability and freight rates	• Global economic growth and conditions
• Market trading activities and strategies	• Costs of oil production and refining
• Short term decisions of oil producing countries, National Oil Companies (NOCs) and nations holding strategic reserves	• Technological progress
• Alternative fuel developments	• Long term policies of NOCs and oil producing nations
• Population growth	• Regulation and government policy

Source: *Australian Institute of Petroleum (AIP), "Facts About the International Fuels Market & Prices", www.aip.com.au 01.02.2013.*

According to US Energy Information Administration (EIA), 6 key factors influencing crude oil price include production, oil discoveries in global scale, financial markets, demand, demand of non-OECD member countries like China, India and Saudi Arabia, and spot markets (Fessler, 2011). Depending on the said factors, oil prices have from time to time exhibited very critical deviations in the historical process. The trend followed by the oil prices from the 1970s to today is shown in Graph 1.

Graph 1. Crude Oil Spot Prices (US dollars per barrel)



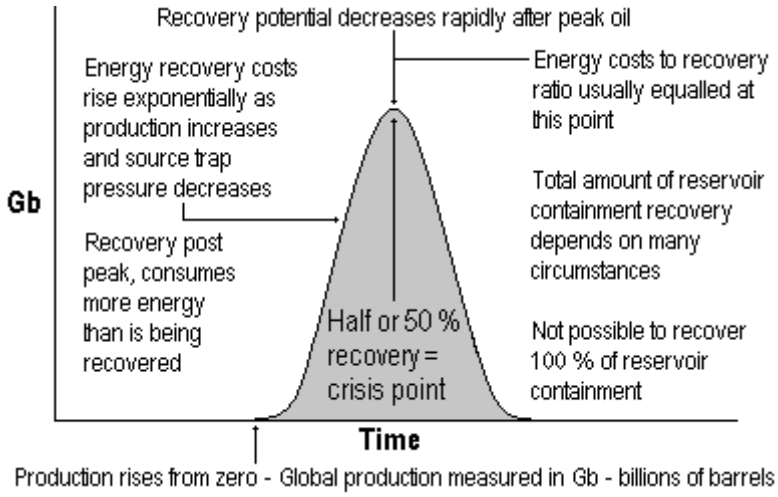
Source:*OECD (2011), OECD Factbook 2011-2012:Economic, Environmental and Social Statistics*

The 1973 Arab oil embargo had a major price impact as Arabian Light prices surged from USD 1.84/barrel in 1972 to USD 10.98 in 1974. The next spike after 1973 came in 1981, in the wake of the Iranian revolution, when prices rose to a high of nearly USD 40. Prices declined gradually after this crisis.They dropped considerably in 1986 when Saudi Arabia increased its oil production substantially.The first Gulf crisis in 1990 brought a new peak.In 1997, crude oil prices started to decline due to the impact of the Asian financial crisis.Prices started to increase again in 1999 with OPEC target reductions and tightening stocks.A dip occurred in 2001 and 2002, but the expectation of war in Iraq raised prices to over USD 30 in the first quarter of 2003. Prices remained high in the latter part of 2003 and in 2004. Crude oil prices increased dramatically in late August 2005 after Hurricane Katrina hit the US coast of the Gulf of Mexico.Prices continued to increase throughout 2006 as the demand for oil in emerging economies, especially China, put pressure on the supply/demand balance, averaging 24 per cent higher than the previous year.In 2007, the increase continued with Dubai hitting USD 88.82/barrel at the beginning of November and WTI climbing to USD 96.50/barrel.In early 2008, prices crossed the symbolic USD 100/barrel threshold and reached a new peak just under USD 150/barrel in July 2008; this brought the real price of oil in 2008 to an all time high.At the beginning of 2009, prices fell to USD 40/barrel as the impact of high prices and the onset of the global financial crisis sharply curbed oil demand.Later in the year, prices ranged between USD 70 and 80/barrel.Crude oil prices increased steadily throughout 2010and 2011 with the post-recession demand rebound, tightening stocks and low spare capacity.In 2012, prices continued to increase at the beginning of the year, averaging USD 122.40/barrel in March, before declining to under USD 100/barrel in June.(OECD, 2011).

Various estimations are made within the framework of Hubbert Curve about the trend to be followed by the oil prices in the upcoming terms. According to the Hubber Curve reflecting the course of production over time for the resources with limited reservoir, once a natural resource is discovered, its production increases rapidly in the beginning and peaks at a certain point of the time. Expressing that price of the old energy resource will stand high for the new energy resource to become more attractive in the

regions where production decreases, Ediger (2007) draws the attention to the fact that oil importation cost will increase henceforward. This is expected to be reflected on the energy bills of the countries such as Turkey, which are highly external dependent in respect of basic energy resources, particularly oil.

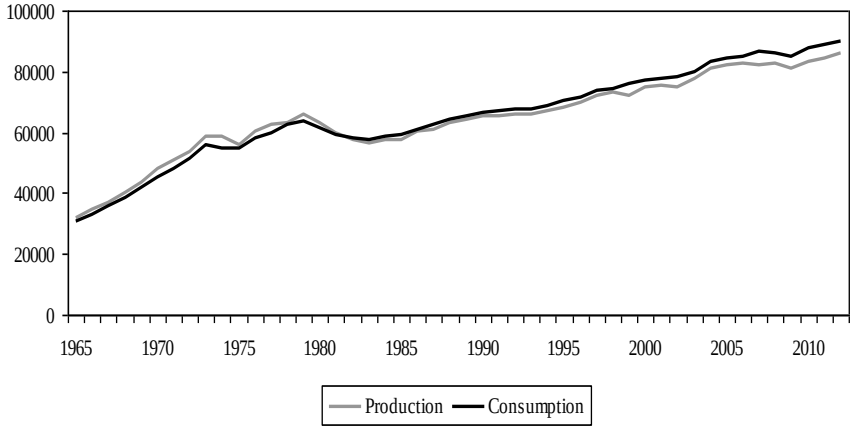
Graph 2.Hubbert Curve



Source: *www.hiram-caton.com 05/05/2013; Hubbert, M. King (1956), "Nuclear Energy and The Fossil Fuels", Shell Development Company Exploration and Research Division, Publication 95.*

Along with the economies' beginning to recover following the 2008 global crisis, the balances involving production and consumption also strengthen the expectations that the oil prices may increase. However, when considered along with other factors, there is an uncertainty about the exact trend to be followed by the oil prices in the future.

Graph 3.World Oil Production and Consumption (thousands barrels daily)



Source:*BP Statistical Review of World Energy 2012*

Like with other developing countries, as the energy demand of Turkey at production phase is high, the increase in oil prices could lead to cost inflation. On the other hand, persistency and scale of the shock in the oil markets as well as the money and finance policies to be implemented by the central bank and government in this course are of great importance as well. Moreover, the increase in oil prices contribute to growth of

the current transactions deficit by increasing the energy bill (Yetkiner and Berk, 2008). As a matter of fact, the current transactions deficit of 77 billion dollars, corresponding to 10 percent of the national income in 2011, consisted of energy importation by around 70 percent with 54 billion dollars. In 2012 when oil prices stood high in average, a resource of around 60 billion dollars was allocated for importation of energy resources. This figure amounts to 25 percent of the total importation. Share of the energy importation that stood around 10 percent until 2005 within the total importation raised to over 20 percent recently as a result of increase of the international energy prices and high growth performance (Yıldırım, 2013). In parallel to this, for struggling with current deficit, increasing the share of the domestic and renewable resources in energy, reducing the dependency on importation by supporting the efforts providing energy efficiency are also presented as a measure in the Medium Term Development Programme for 2013-2015, prepared by the Ministry of Development.

LITERATURE REVIEW

A number of empirical studies on the relationship between oil price and economic growth have been carried out using different estimation approaches. Table 2 summarizes the various studies in this field.

Table 2. Overview of Previous Studies

Author	Methodology	Period	Country	Results
Narayan et. al. (2014)	Predictability tests, Robustness tests	1983-2010	28 developed and 17 developing countries	The nominal oil price predicts economic growth for 37 countries—16developing and 21 developed countries.
Oriakhi and Osaze (2013)	VAR methodology	1970-2010	Nigeria	Oil price changes determine government expenditure level, which in turn determines the growth of the Nigerian economy.
Chatziantoniou et. al. (2013)	Structural VAR model	2000-2010	Four European economies (France, Italy, Spain and Greece)	Aggregate demand oil price shocks exercise a lagged effect, either directly or indirectly, to tourism generated income and economic growth.
Gökçe (2013)	Exponential GARCH(p,q) model and Structural VAR model	1987-2011	Turkey	Quarterly economic growth decreases by 0.0164 points and this finding is of strong statistical significance.
Asgari (2013)	Johansen-Juselius	1971-2007	Iran	Increase of oil price in the world markets has had significant and positive effect on Iran economic growth in the

	cointegration			studied period and there is a reverse relationship between inflation rate and Iran economic variables.
Lee and Chiu(2011)	Johansen cointegration technique, the Granger non-causality test, the generalized impulse response function, and the generalized forecast error variance decomposition	1965 - 2008	Canada, France, Germany, Japan, the United Kingdom, the United States.	Nuclear energy consumption, real oil price, oil consumption, and real income are cointegrated.
Du et. al. (2010)	Multivariate vector autoregression (VAR)	1995-2008	China	The world oil price affects the economic growth and inflation of China significantly, and the impact is non-linear.
Jayaraman and Choong (2009)	ARDL bounds testing methodology	Samoa: 1982–2007; Solomon Islands: 1980–2007; Tonga: 1981–2007; Vanuatu: 1980–2007	Small Pacific Island Countries Samoa, Solomon Islands, Tonga and Vanuatu	The oil price, gross domestic product and international reserve are cointegrated in all the four PICs
Hanabusa(2009)	AR-EGARCH models, cross-correlation functions	2000-2008	Japan	Each causality in mean and variance between the economic growth rate and the oil price change is an impact of the feedback.
Zhang (2008)	Non-linear approach developed by Hamilton	1957-2006	Japan	Empirical evidence confirmed the existence of nonlinearity between oil price shocks and economic growth, and a flexible nonlinear model is estimated.

DATA AND METHODOLOGY

The annual time series data, which covers the period 1980-2013, are utilised in this study. The variables used in this study are International Oil Prices (PR) and Gross Domestic Product (GDP). These variables are obtained from the database of World Bank, and official website of BP. The data and resources were shown at Table 3.

Table 3. The Data Set

Variable	Explanation	Resources
GDP	Gross Domestic Product, $	World Bank
PR	Oil Price, $	BP

For analyzing and evaluating the correlation between the variables, following econometric methods were used:

- Unit Root Test
- Johansen Cointegration Test
- Impulse-Response Function
- Variance Decomposition Test

EMPRICAL RESULTS

To analyze the long run cointegrated relationship among the different variables by applying the VAR model, firstly, it is necessary to test stationarity and the order of integration of the variables in the model. If some or all of the variables in the model are non-stationary, conventional hypothesis-testing and confidence intervals will be unreliable. In the existence of non-stationary variables, there might be a so-called spurious regression. A spurious regression has a high R^2 and a t-statistic that appears to be significant, but actually have no economic meaning (Alhajhoj, 2007: 3651). All the data series were tested for stationarity to avoid statistically spurious relationships. For this purpose the Augmented Dickey-Fuller unit root test was used and test results are presented in Table 4.

Table 4. Results of ADF Unit Root Test

Variables	Level	First Difference	Test Critical Values			Decision	Order of Integration
			1% level	5% level	10% level		
GDP	-0.069099 (0.9448)	-6.086541 (0.0000)	-3.646342	-2.954021	-2.615817	Nonstationary at level but stationary at first difference	*I* (1)
PR	-0.240231 (0.9233)	-4.449803 (0.0013)	-3.646342	-2.954021	-2.615817	Nonstationary at level but stationary at first difference	*I* (1)

The unit root test results show that variables are non-stationary at level form but do not contain unit root after first differencing.

Secondly, it is necessary to determine optimal lag length of VAR model using information criteria. Table 5 shows the optimal lag length selection for the VAR

procedure under the sequential modified LR test statistic, final prediction error (FPE), Akaike (AIC), Schwarz (SC) and Hannan-Quinn (HQ) information criteria.

Table 5.VAR Model Lag Length Determination Criterion Results

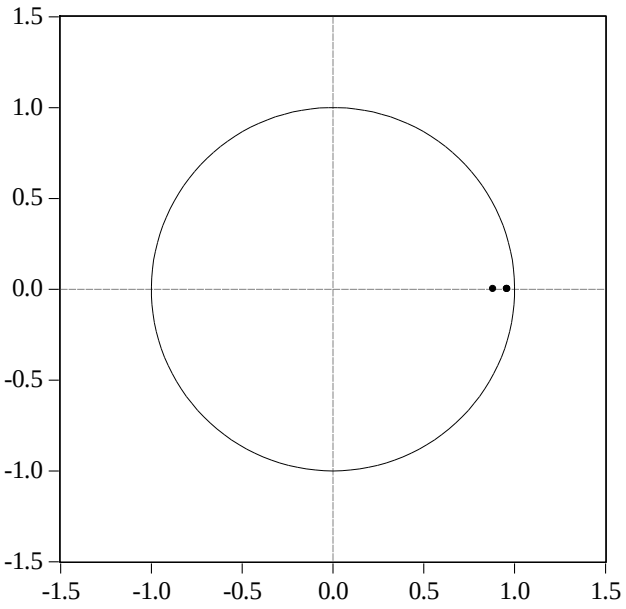
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1.622351	NA	0.004331	0.233700	0.326215	0.263858
1	69.44643	128.3823*	5.73e-05*	-4.093318*	-3.815772*	-4.002845*
2	70.16093	1.198523	7.11e-05	-3.881350	-3.418774	-3.730562
3	71.33811	1.822735	8.62e-05	-3.699233	-3.051626	-3.488129

* Shows the lag length selected by the criterion.

The optimal lag length is 1 according to all information criteria.

The stability of the VAR model was tested using AR root graph that shows the inverse roots of the AR polynomial.

Graph 4. Inverse Roots of AR Characteristic Polynomial



The points in the graph are the inverse roots of the VAR model. It can be seen in the graph all the points are in the circle, which means the VAR (1) containing gross domestic product and oil price is stationary.

In the next step Johansen trace and maximum eigenvalue cointegration tests were used to determine whether there is a long term relationship between oil price and economic growth. The results of the trace and maximum eigenvalue tests are reported in Table 6 which shows the number of cointegrating vectors.

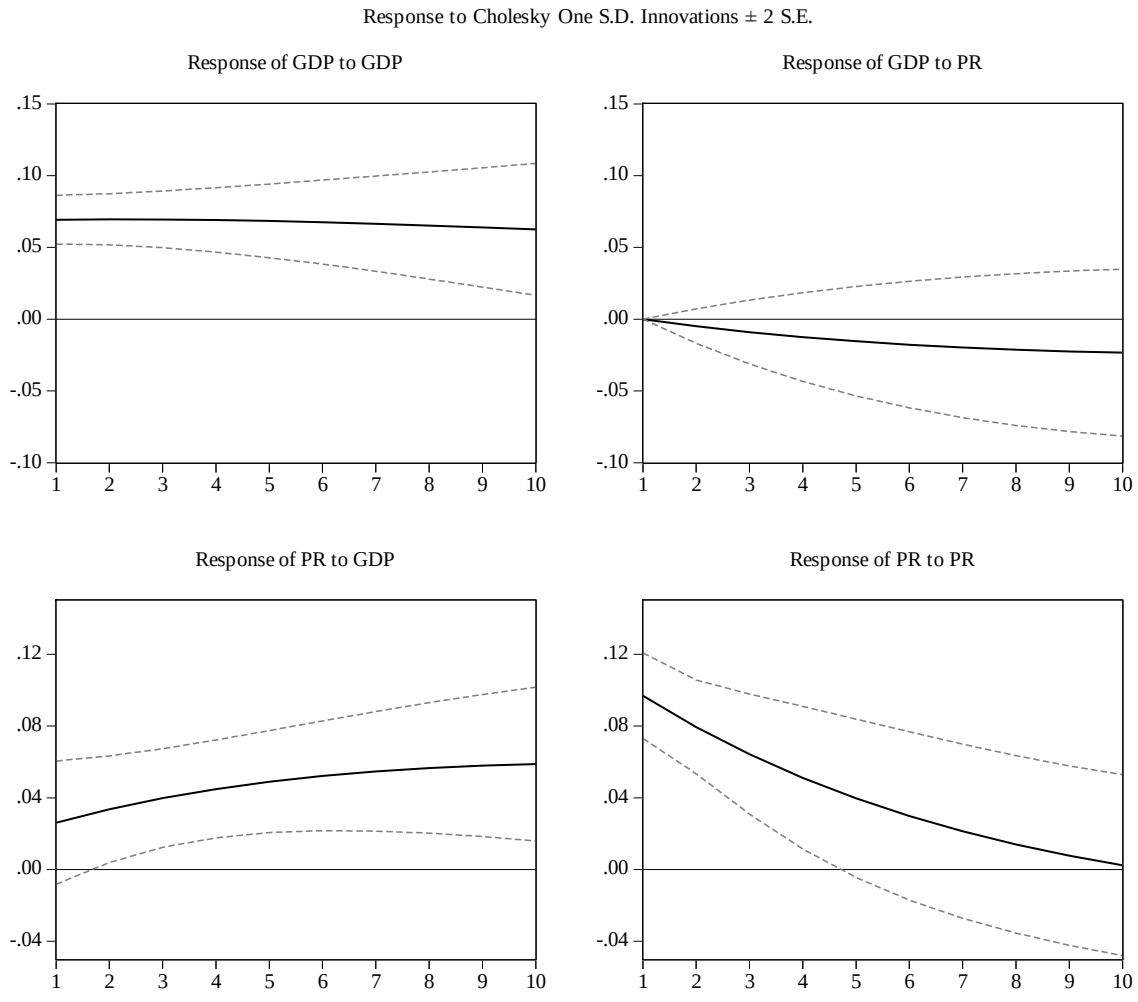
Table 6. Results of Johansen Cointegration Test

Number of Assumed Cointegration Equalities	Trace Test			Maximum Eigenvalue Test	
	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
0	0.205259	7.554470	15.49471	7.351641	14.26460
Maximum 1	0.006318	0.202829	3.841466	0.202829	3.841466

The cointegration tests showed that there is no cointegration among the variables. Hence, there is no long term relationship between oil price and economic growth in Turkey.

To examine the short term relationship between GDP and oil price, impulse response functions and variance decomposition were used. The impulse response function for the variables was depicted in Graph 5.

Graph 5. Impulse-Response Functions



Impulse response functions indicate that oil price shocks have a negative impact on gross domestic product.

Finally variance decomposition analysis was used to measure the proportion of forecast error variance in a variable that is explained by innovations in itself and the other variables. The variance decomposition of the VAR was presented in Table 7.

Table 7. Variance Decomposition

Variance Decomposition of GDP: Period	GDP	PR	Variance Decomposition of PR: Period	PR	GDP
1	100.0000	0.000000	1	93.25966	6.740343
2	99.74997	0.250032	2	89.68519	10.31481
3	99.27104	0.728957	3	85.40369	14.59631
4	98.65032	1.349675	4	80.59403	19.40597
5	97.94946	2.050535	5	75.47707	24.52293
6	97.21131	2.788688	6	70.28179	29.71821
7	96.46510	3.534901	7	65.21377	34.78623
8	95.73033	4.269670	8	60.43379	39.56621
9	95.01962	4.980377	9	56.04948	43.95052
10	94.34077	5.659226	10	52.11788	47.88212

According to variance decomposition, around 6 percent variation in gross domestic product was explained by international oil prices in the 10th term. On the other hand, 47 percent variation in international oil prices was explained by gross domestic product.

CONCLUSION

This study aims to determine the effects of oil price on economic growth for Turkey from the period 1980-2013. For this purpose unit root test, Johansen cointegration test, impulse response functions and variance decomposition were applied. According to obtained results there is no relationship between these variables in the long run. Impulse response functions showed that an oil price shock has a negative impact on gross domestic product in the short run. In this context, Turkey should reduce its energy dependence on foreign suppliers. Turkey has renewable energy potential. It should utilize renewable energy resources such as wind, solar, geothermal and hydro.

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