JEESS
Journal of Empirical Economics and Social Sciences
Uygulamalı Ekonomi ve Sosyal Bilimler Dergisi
Cilt/Volume: 2 Sayı/Issue: 1 Mart/March 2020 ss./pp. 59-81
N.M.M. Aimer

THE IMPACT OF OIL PRICE SHOCKS ON THE ECONOMIC GROWTH OF LIBYA: AN ARDL-BOUND TESTING APPROACH

Nagmi M. Moftah AIMER *

ABSTRACT

This paper examines how oil price shocks affect the Libyan economic growth over the period from 1990 to 2016. Using the autoregressive distributed lag (ARDL) bounds test, the study finds that oil price changes affect the Libyan economic growth. Oil prices are important in explaining GDP movements. Moreover, this test suggests that oil price has a long-term positive impact on economic growth. Our empirical results indicate a two-way causal relationship between oil prices and GDP, while a one-way causal relationship arises from imports and trade openness to oil prices. However, oil price shocks do not appear to have a statistically significant effect on the trade balance. The result shows that the country should formulate appropriate energy conservation policies taking into cognizance of her peculiar condition.

Keywords: *Oil prices shocks, Economic growth, Libyan economy, ARDL, bounds test*

JEL Codes: *J41, L42, J49*

1. INTRODUCTION

Today, Owing to its strategic nature, oil is an important commodity, affecting world economies. Fluctuations in world oil prices affect government revenue and current account balances of countries. In addition to their effect on domestic price movements and economic growth, as well as issues related to labor (Esen and Bayrak, 2015). Energy supply may be affected by events such aspolitical instability of energy producing countries, attacks on energy infrastructure, accidents, natural disasters, war and terrorism. Such conditions may lead to critical oil output cuts and uncertainties in energy supply or demand, which may lead to volatility, especially in oil prices (Esen, 2016). Significant reduction in oil prices in the global markets has recently caused threats for oil producing economies such as collapse and bankruptcy because they linked the fate of their economies with the oil exports, which is now making them pay a heavy price for that policy. The fears were most acute in economies that relied on oil as their sole source of annual budgets and a major source of GDP.

* Institute for Social Sciences, Department of Business Administration, Kastamonu University, Kastamonu, Turkey. najmimuftah@gmail.com

Makale Geçmişi/Article History

Başvuru Tarihi / Date of Application	: 18 Haziran / June 2020
Düzeltme Tarihi / Revision Date	: 30 Aralık / December 2019
Kabul Tarihi / Acceptance Date	: 10 Şubat / February 2020

Research Article

Hamilton (2011) points to previous oil shocks as a strong indicator behind recessions, for example, rapid increases in oil prices have resulted in 10 out of 11 peaks in the US business cycle since World War II. It can be said that the consumer prices, which have been falling for the last 10 years in the developed countries, could be boosted by rising energy prices, fueling core inflation and accelerating the returns of central banks back to the level of pre-crisis interest rates. The government subsidies are a strong sign that the cost of crude oil and falling currencies are eroding revenues in other countries. During the past 30 years, the world oil market has suffered three severe oil shocks, described as historic, and can be summarized as follows:

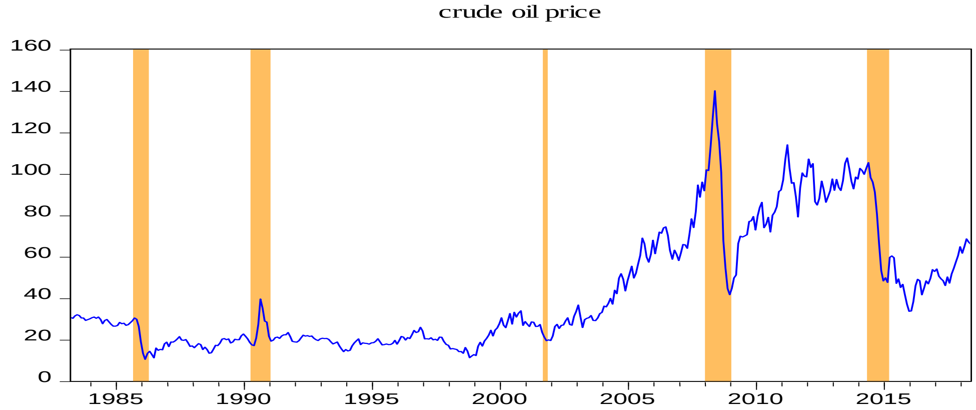
The first oil shock emerged after the Arab-Israeli War that began in October 1973, when Arab states increased oil prices. Some Arab oil supplies were cut off from the advanced industrial countries allied to the Hebrew state that resulted in sudden reduction the production ceiling. These cuts nearly quadrupled the price of oil from $2.90 a barrel before the embargo to $11.65 a barrel in January 1974. In March 1974, amid disagreements within OAPEC on how long to continue the punishment, the embargo was officially lifted. The higher oil prices, on the other hand, remained (Merrill, 2007).

Prices stabilized between $ 12.5 and $ 14 between 1974 and 1978 and OPEC production was stable at 30 million barrels per day. But keeping prices high also contributed to the increase in non-OPEC production during the same period, rising from 25 million barrels per day to 31 million barrels per day.

A second shock occurred after the Iranian Revolution in February 1979, which cut off the supply of Iranian oil from the international markets for a few months and thus reduced quantities of oil. In 1979, the Islamic Revolution in Iran was launched and oil supplies were cut off by about 2 million barrels per day. Prices doubled that year to a face value of $ 25 a barrel. This was the highest value for a barrel of oil since World War II.

In 1980, the Iraq-Iran war began, which caused total oil production from both countries to fall from 6.5 million bpd before the war to around 1 million bpd in 1981. Because of the Gulf War, average oil prices rose to $ 35 in 1980 and then to $ 37. In 1981 this was the highest value a barrel of oil has ever had. Between 2000 and 2008, the demand for oil in the world increased dramatically after the growth of demand from China, India and other emerging countries as it was then called. However, the growth in demand was surprising and OPEC was not ready for it, which caused prices to rise due to limited oil supply growth to the growth of demand. But 2008 was a disappointment. That year, speculation intensified on oil prices and contributed to the rise in prices to 147 in July of that year, the highest level in history. However, prices collapsed in the second half of that year as speculation and demand weakened due to the global financial crisis, created by the fall of major US banks and the collapse of mortgage companies. Prices fell by the end of 2008 to below $ 40 a barrel.

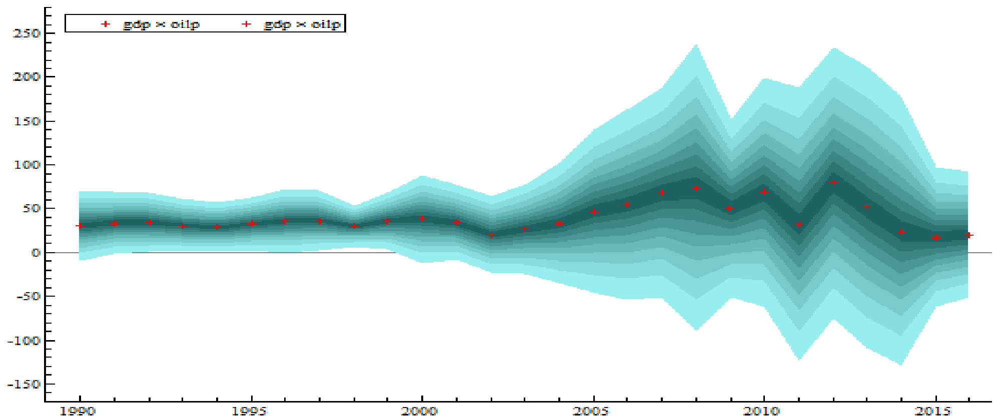
Figure 1 Historical events of oil price volatility during the period (Apr 1985-Jun 2018)



Source: US Energy Information Agency

It relies on its revenues to finance more than 59% of the public expenditures and about 59% of GDP. Oil exports account for about 55% of the total exports. Libya has the largest oil reserves in. Libya's oil production continued to decline during the first half of 2016 that was just 296,000 barrels per day in May as compared to 348,000 barrels in April and about 379 thousand barrels during the first quarter of the same year. This indicates the continued deterioration of the oil extraction and supply situation, which resulted in the closure of two major ports since December 2017 namely Sidra and Ras Lanuf, and that led to a decline in the volume of oil exports from about 1.3 million barrels in 2010 to about 160 thousand barrels by the end of the third quarter. Since 2015, this situation resulted in reducing oil exports to 10.6 billion Libyan dinars in 2015 as compared to 55.7 billion Libyan dinars in 2010. Consequently, it is clear that higher oil prices are positively linked with the Libyan economic development (Aimer, 2016, 2017). The following figure 2 shows the evolution of world oil prices and Libyan GDP.

Figure 2 Gross domestic product and crude oil price in Libya



The following Figure 3 shows the evolution of world oil prices and Libyan imports.

Figure 3 The evolution of world oil prices and Libyan imports

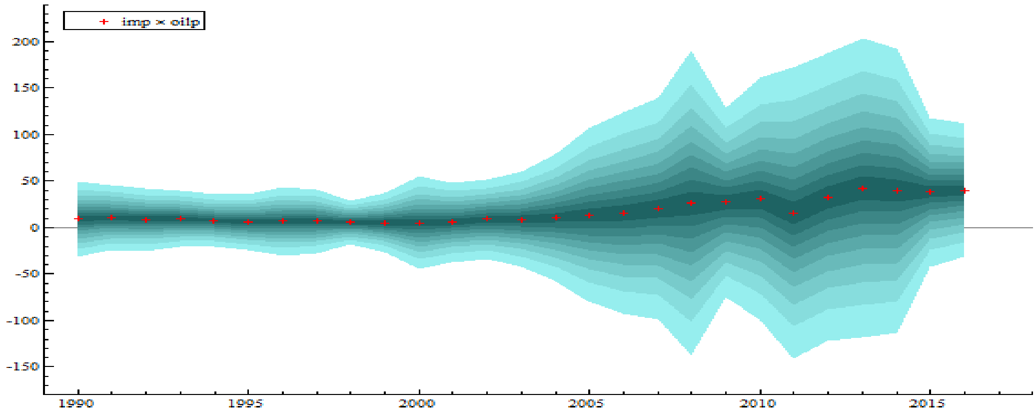


Table 1. The development of the rate of production and consumption of Libyan oil

	Production per million barrels per day			Domestic consumption in thousand metric tons per day
	Daily average	total	Change in total	
2010	1.7	616	4.0	12,131
2011	0.5	178.6	-71	7,825
2012	1.5	530.7	197.1	10,666.1
2013	1.0	362.6	-31.7	7,707
2014	0.5	175.2	-51.7	11,707.6
2015	0.4	146.6	-16.3	9,761.7

Source: Central Bank of Libya economic bulletin, department of research and statistics, volume 22, 4th quarter 6

Table 1 shows that the Libyan oil production has significantly fluctuated since 2011 as a result of the events in the country since 2011, which reduced the oil excavation from 1.1 million barrels per day in 2010 to around 50 thousand barrels per day in 2011. Later it rose to 5 million barrels between 2012 and 2013, which declined again due to political instability to less than 400 thousand barrels a day, which is just one fifth of the production in 2010.

It is seen that some of the studies mentioned above ignore the impact of changes in oil prices on the Libyan economy. To this end, our study aims to study the effects of global oil price fluctuations on Libyan economic growth and adding new knowledge to the literature. For this reason, we applied the autoregressive distributed lag (ARDL) bounds test to understand the impact of varying oil price fluctuations on growth, which is also appropriate for analyzing the underlying relationship between 1990 to 2016.

To achieve the goal of the research, the rest of the study is organized as follows: The second section examines the discussion of previous literature is relevant to the research topic. While the third section explores the link between the Libyan economic growth and the oil prices using a distributed autoregressive model. Finally, Section 4 presents the results and recommendations.

2. LITERATURE REVIEW

Despite the fact that several scientific and theoretical studies show different findings on the link between a country's economic development and the oil prices, the previous researches have been mainly focusing on developed countries (see Tatom, Rasche, and Bernanke, 1983). Van Eyden et al. (2019) finds that the volatility of oil prices has a significant negative and statistical impact on OECD economic growth from 1870 to 2013.

A main aim of these previously conducted studies has been checking whether there was correlation between the 1973 oil crisis and the recession of the 1970s. Consequently, studies showed negative/inverse relationship between production, oil prices and not-so-strong effect on the economic growth. Rasche, & Tatom (1977) claimed that the fluctuations in the oil prices indicate crisis on the supply-side of an economy that reduces real production (real output). Rising oil prices mean increase in energy scarcity, and then a decline in potential production due to scarce oil leading to reduction in output and production. He also concluded that oil price surge was partially responsible for all stages of recession in the US after the Second World War except for the 1960's crisis (Hamilton, 1983). Bernanke (1983) believes that the oil price crisis tends to reduce value added, as companies are more likely to postpone irreversible investment decisions while seeking to know whether high oil prices are transitory or permanent. Consequently, producers prefer to postpone sustainable investment decisions when they do not have a clear picture of volatile oil prices in the future. This type of decisions negatively affects production and economic growth. Hooker (1996) believes that the rising oil prices had no significant impact on the US economy after the oil crisis of 1973. Bernanke et al. (1997) claimed that the US economy faced the effect of rising and fluctuating oil price fluctuations because of the US Government's stringent monetary policies; therefore, changes in the oil prices was not a significant factor to blame. Differing with Bernanke et al., Rotemberg and Woodford (1996) claimed that souring oil prices resulted in reducing real wages/cost of labor. Agreeing with Woodford and Rotemberg, Finn (2000) claimed in his model that the integrated energy is a major input for capital exploitation. This model takes fluctuations more seriously because according to its findings, the production capital is a function of energy consumption. Thus, rising oil prices result in energy consumption reduction and at the same time exploitation of capital as well. It leads to reduced production and marginal productivity of labor. Rogoff (2006) believes that if the energy efficiency is increased, and if the oil consumption is more than its demand, the government should adopt a tight monetary policy by creating flexible labor markets and active financial markets, which will certainly overcome the impact of oil crises.

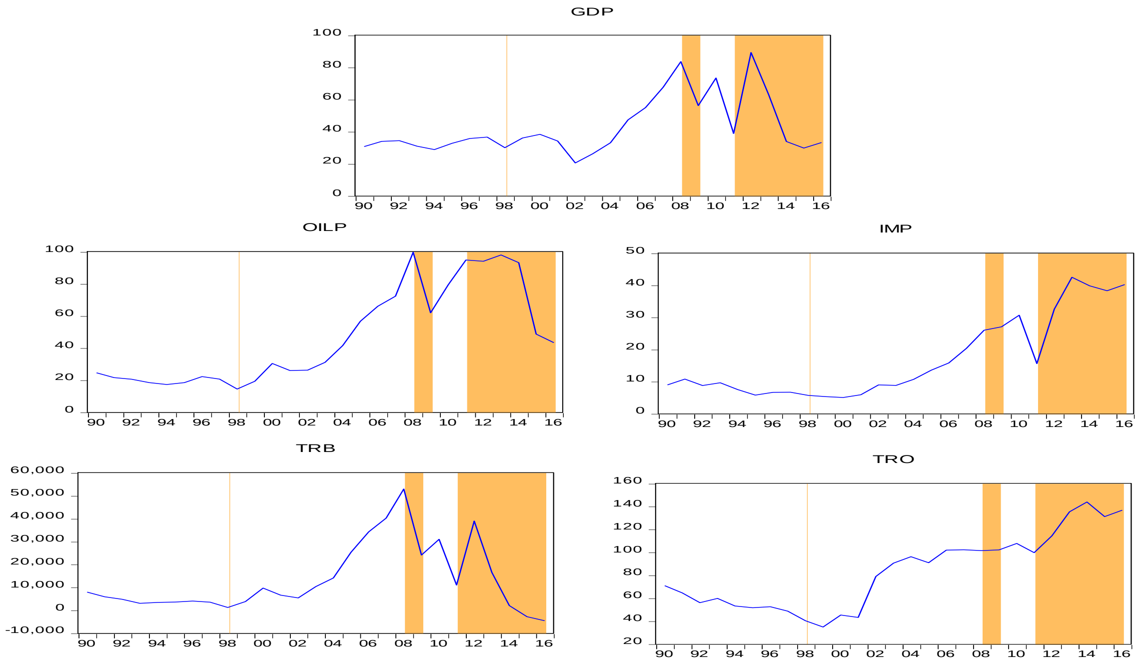
The above-mentioned studies show that high oil prices negatively affect industrial production as well as economic development; however, all of them show that this relation has not been stable in case of developing countries. Blanchard and Gali (2007) confirmed this finding in their study when they compared production and inflation with oil price shocks of oil prices while studying some developed economies. They also tried to understand a significant reason behind the economies' weak response, which is linked with dependence on less energy, enhancement of the flexibility in the labor market, and improvements in the monetary policy. As for developing economies, some studies explore the relation between economic development and oil prices but they showed different results. Chang, Wong (2003) explored the impact of oil price volatility on economic development in Singapore. They reported that there was inverse/negative relation between oil price surge, unemployment and inflation. Jumah, Pastuszyn (2007) found that the prices of oil bear a negative effect on the total real production in Ghana. Farzanegan, & Markwardt (2009) also reported that there was inverse relationship between oil prices and the South African economic development. In addition, studies conducted by Oriakhi, Osaze (2013), Olomola, Jumo (2006), and Akpan (2009) revealed positive relation between Nigerian production growth and the oil prices. It should be remembered that Nigeria is a crude oil exporting country. The available literature reveals those paths, in which, oil price changes can affect economic growth such as the supply side impact, the impact on inflation, and the effect of real equilibrium (Brown and Yucel 2002; Sanchez and Jiménez-Rodríguez, 2005; Das, Bose and Bhanumurthy, 2014). In addition, the import channel links the oil price with the current account balance as well as gross domestic product. Assuming that the demand for oil is not affected by price changes, a surge in the international oil price increases a country's import bill, if it is an oil importing country while other indicators remain stable. It leads to significant trade balance deficit, and consequently, it leads to the deterioration of the current account balance of the country. Ultimately, the rate of economic development is likely to fall. Another thing that happens after the international oil price increase is the increase in prices of local commodities; however, every rise in international oil prices does not essentially reflect the local commodity prices. As China is the world's third-largest oil importer and the world's second-largest consumer, volatile global oil prices will have a major impact on China. It is seen that some of the studies mentioned above ignore the impact of changes in oil prices on the Libyan economy.

3. THE ECONOMETRIC METHODOLOGY

3.1. Descriptive Analysis

The data used in this study were derived from various sources, which were collected from reliable databases. The variables used in this study are crude oil price (Cushing, OK WTI Spot Price FOB (Dollars per Barrel)), GDP, trade openness as a percentage of GDP, trade balance and imports of goods and services. The graph below shows the direction of the variables between 1990 and 2016.

Figure 4 Graphs of variables (1990 to 2016)



The Libyan economy relies mainly on oil revenues, which in practice contributes more than 59 percent of the GDP. The Fig.4 shows the direction of the variables between 1990 and 2016. The GDP growth rate after the year 2000 is estimated at 10.6% of GDP in 2010, and because of the Libyan war, economy deteriorated by 62.1% in 2011, and thus, per capita GDP fell by 40 percent in the 1980s.

In 2011, there was an increase in Libya's GDP due to high oil prices, increased foreign direct investment after the suspension of UN sanctions in 1999 and the end of the long-term drought. Real GDP growth was boosted by rising oil revenues. According to Table 2, all the kurtosis and skewness values of all the studied variables fall within an acceptable range. Thus, all the variables can be considered compatible, and all the indicators are good (see George, 2011and Hair et al. 2016, p.75). Matrix of correlation coefficients. The nature of the relationship between the two variables, see Table 3.

Table 2 Statistics of the study variables (1990-2016) (level)

	GDP	OILP	TRB	TRO	IMP
Mean	42.68444	46.68407	13185.33	83.46185	16.93633
Std. Dev.	18.07844	29.96882	14795.57	32.90591	12.66197
Skewness	1.292466	0.638710	1.181911	0.224125	0.885969
Kurtosis	3.560726	1.871582	3.397400	1.865438	2.265700
Jarque-Bera	7.870823	3.268272	6.463778	1.674178	4.138833
Probability	0.019538	0.195121	0.039483	0.432969	0.126259

Table 3 Matrix of correlation coefficients

	GDP	OILP	IMP	TRB
GDP				
OILP	0.62**			
IMP	0.28	0.75**		
TRB	0.93**	0.67**	0.26	
TRO	0.23	0.79**	0.91**	0.33

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficients table shows the relation between these variables showing direction and strength of the link between the given variables, and high correlation value has been found between them. The direction of the relationship is positive; i.e., rising crude oil prices increase the GDP, trade balance, trade openness and imports (0.62; 0.67; 0.79; 0.75) respectively. However, this correlation as well as determining the direction of influence between variables does not provide sufficient evidence of a causal relationship. These variables may be associated with some of those, which are linked with Dalia, which tends to synchronize their movements or affect them with common factors. The standard regression models and tests will be used to determine the validity of these correlations.

3.2. First: Test Cointegration Using the ARDL Process

For monitoring the link between oil prices and growth, we use the autoregressive slowdown approach (ARDL). Pesaran at el. (2001) tried to overcome the shortcomings of the proposed methods proposed by Granger. The most important advantage of this method is its applicability regardless of time series in the study, which is integrally I(0) or 1(I) or a combination of the two, but the only condition is that there are no integrated time series higher than 1(I).

Co-integration using ARDL is tested using bound test method, where Autoregressive model, AR(p) and Distributed Lag models are integrated. In this methodology, the time series is a function of slowing down values and the values of explanatory variables while taking them with one period or more. The ARDL method is used to test cointegration, and it has several advantages:

- It is applicable irrespective of either the considered variables have integrated with grade I(0) or different degrees, i.e. they can be applied when the rank of integration, which is unknown or not uniform for all the studied variables.

- The results of their application will be good if the size of the sample (the number of views) is small, and this is unlike most traditional integration tests that require large sample sizes for better results.
- It is use helps estimating the components of long-term and short-term (relations) together and at the same time in one equation instead of two separate equations.

According to the study methodology, the ARDL method will be used in three stages:

In the first stage, the co-integration is tested in the framework of UECM, which takes the following formula by defining relation between Y, the dependent variable, and vector of independent variables X:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \theta_i \Delta X_{t-i} + \lambda_1 Y_{t-1} + \lambda_2 X_{t-1} + \eta_t \qquad (1a)$$

Here λ_1, λ_2 are long term relationship coefficients, and β, θ express short-term relationship information, Δ refers to the first differences of variables while representing n, m for periods of time delay (lags for variables). It is not necessary that the number of time lag periods is at the same level (n≠m). η is a random error limit that has 0 arithmetic mean, a constant variation, and no serial correlations.

Later, the relationship between variables in long-term is verified using the Bound (Pesaran et al., 2001), which depends on the F-statistic value (Wald) test, and it tests the hypothesis of non-integration of variables versus a co-integration to detect the variables' long-run equilibrium relation. Co-integration of equation-1 variables has been tested by the following assumptions:

$$\begin{cases} H_0: \lambda_1 = \lambda_2 = 0\,, \\ \text{The null hypothesis: Lack of cointegration.} \\ H_1: \lambda_1 \neq 0, \lambda_2 \neq 0, \\ \text{The alternative hypothesis: a cointegration.} \end{cases} \qquad (1b)$$

In Eq. (1b), the rejection of H0 hypothesis by the standart F- (or Wald-) tests leads to the acceptance of H1 hypothesis and indicates a long run equilibrium relationship between the variables. In this case, null hypothesis H_0 will be rejected after comparison of the F value, which has been calculated by the tabular values from the Wald test (F- statistic), and it is compared with tabular values. Here we have two values (Bound Critical Lower LCB and Upper Critical Bound (UCB). When the F value is higher as compared to upper tabular value, long-run relation exists between the variables (i.e. rejecting zero hypothesis), and if the statistical-F value lies between the lowest value and greatest value, testing remains inconclusive. When statistic-F value is below a minimum table value, no long-run relation exists between the variables (i.e. acceptance of the null hypothesis).

In the case of a there is co-integration between the variables, the second stage includes estimating the long-term Eq. (2).

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \vartheta_i Y_{t-1} + \sum_{i=0}^{q} \delta_i X_{t-1} + \mathcal{E}_t \quad (2)$$

Where, ϑ and δ are variable coefficients, p and q are periods of lags for those variables, Ɛ represents the random error limit. The lag level is selected in an ARDL model. The lag rank is selected as per Akaike (AIC) (Akaike 1973), when the OLS model is used to eliminate the serial or autoregressive random errors. According to Pesaran & Shin (1998), a maximum of two lags for annual data are selected.

In the third stage, the ARDL description can be derived for short-run using error correction model (ECM) as in Eq. (3).

$$\Delta Y_t = \text{c} + \sum_{i=1}^{p} \vartheta_i \Delta Y_{t-1} + \sum_{i=0}^{q} \delta_i \Delta X_{t-1} + \psi(ECT)_t + \upsilon_t \quad (3)$$

3.3. Specifications and Data of the Model

As mentioned previously, the main objective is the role of oil price fluctuations in economic growth. To do this, we will estimate this relationship as in Eq. (4):

$$(GDP)_t = \alpha + \beta_1 (TRB)_{t-1} + \beta_2 (OILP)_t + \beta_3 (TRO)_t + \beta_4 (IMP)_t + \mathcal{E}_t \quad (4)$$

t=1,2,..,T

Were, t = time period; T = number of views;

GDP gross domestic product is the economic growth and represents the dependent variable; (OILP) is crude oil prices; trade balance (TRB); imports (IMP) and trade openness (TRO).

Ɛ is the random error limit or residual; α is constant limit; β is the GDP elasticity coefficient.

All data on model variables (excluding oil prices) were collected from IMF, and the data pertaining to crude oil prices has been taken from EIA.

3.4. Stationarity Test

In standard analysis, before starting standard work and estimating the model, a series stability test must be performed to determine the type of regression. Is it a real regression or a false regression? If time series data is used and its variable has a general trend or seasonal fluctuations, which makes it unstable, it indicates that the regression results are false and the series is unstable. The stability test must be performed for time series and the unstable variable must stabilize. There are two series stability tests Dickey & Fuller (1981) (ADF) and Phillips & Perron (1988) (PP). Each is tested at three levels, (the first difference and the second difference). If the value of the Doppler (ADF) test or the Phelps Peron test (PP) is greater when compared with the tabular value, at which, the probability of confidence shows that the series is stable. Moreover, each variable has been tested separately to determine the degree of stability at 95% dependency level. A Tables 4, 5 are created for determining the variables' stability.

Table 4 Outcomes of Unit Root Tests for All The Tested Variables

	At Level					
		GDP	OILP	IMP	TRB	TRO
Constant	t-Statistic	-2.6222	-1.3424	0.0192	-1.8795	-0.1028
Constant & Trend	t-Statistic	-2.8930	-1.5608	-2.0208	-1.7169	-2.4658
Without C & T	t-Statistic	-0.9016	-0.5048	1.5472	-1.4277	1.0469
	At First Difference					
		d(GDP)	d(OILP)	d(IMP)	d(TRB)	d(TRO)
Constant	t-Statistic	-7.6036***	-5.2015***	-6.1313***	-6.8463***	-4.3742***
Constant & Trend	t-Statistic	-7.5537***	-5.2000***	-14.1359***	-7.0808***	-4.4829***
Without C & T	t-Statistic	-7.7670***	-5.2932***	-5.8047***	-6.9713***	-4.1739***

Table 5 Results from Phillips and Perron test

	At Level					
		GDP	OILP	IMP	TRB	TRO
Constant	t-Statistic	-2,6390*	-1,3424	-0,3174	-1,8715	-0,0184
C& T	t-Statistic	-2,8299	-1,5608	-2,2503	-3,1636	-2,4658
Without Con & Tre	t-Statistic	-0,5760	-0,5048	0,7294	-1,4926	1,1203
	At First Difference					
		d(GDP)	d(OILP)	d(IMP)	d(TRB)	d(TRO)
With Constant	t-Statistic	-7,6047***	-5,2015***	-5,9343***	-7,0363***	-4,3742***
Constant & Trend	t-Statistic	-7,5412***	-5,2000***	-4,5087***	-7,1572***	-4,4856***
Without C & T	t-Statistic	-7,7682***	-5,2932***	-5,7148***	-7,1725***	-4,1843***

(*) 10%; (**)5%; (***)1%.

3.5. Cointegration Regression Model According to ARDL Model

The ARDL method is based on the UECM model and Bound ARDL model suggested by Pesaran at el. (2001) is best to detect the presence of a co-integration of model variables, where the co-integration of the UECM model is tested as Eq. 5.

$$\Delta(GDP)_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta(GDP)_{t-i} + \sum_{i=0}^{q} \Phi_i \Delta(TRB)_{t-i} + \sum_{i=0}^{m} \varphi_i \Delta(OILP)_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta(TRO)_{t-i} + \sum_{i=0}^{s} \vartheta_i \Delta(IMP)_{t-i} + \lambda_1 (GDP)_{t-1} + \lambda_2 (TRB)_{t-1} + \lambda_3 (OILP)_{t-1} + \lambda_4 (TRO)_{t-1} + \lambda_5 (IMP)_{t-1} + \mathcal{E}_t \quad (5)$$

Since there is a cointegration between the strings under study, the assumptions are formulated as given below:

$H_0: \lambda_1 = 0;\ \lambda_2 = 0;\ \lambda_3 = 0;\ \lambda_4 = 0;\ \lambda_5 = 0$ Null hypothesis: lack of cointegration.

$H_1: \lambda_1 \neq 0;\ \lambda_2 \neq 0;\ \lambda_3 \neq 0;\ \lambda_4 \neq 0;\ \lambda_5 \neq 0$ The alternative hypothesis: a cointegration.

3.6. Determining the autoregressive lag length

When this model is estimated, the time lag of number period should be determined earlier for the variables of the first difference for each variable of the model according to the standard (AIC) and the ARDL model is very sensitive to lags and periods.

In this case, we used the *EViews* program by Pesaran, which automatically sets the time lag times to one-time period for each variable.

The most interesting result of this study is that AIC is superior than the other criteria under study in the case of small sample (60 observations and below), in the manners that they minimize the chance of under estimation while maximizing the chance of recovering the true lag length. One direct economic effect of this study is that since most economic sample data are rarely considered "large" in size, it is recommended that AIC be used to estimate autoregressive lag length (see Liew, 2004).

The AIC standard has been adopted for determining the optimum numbers of time delays/lags. The standard concluded that the optimal number of lags that the model draws from the autocorrelation problem is one (Table 6, Panel A). Using this lag, the result of the Johansen maximum eigenvalue test, based on both Johansen (1988) and the modified version suggested by Reinsel and Ahn (1992), points to conclude that there is four cointegrated relationship, at the 5% level of significance (Table 6, Panel B). For AIC, the minimization of this criterion leads to choose the optimal lags: p = 1, q = 2, r = 2, s = 0, w = 1(Table 6, Panel C).

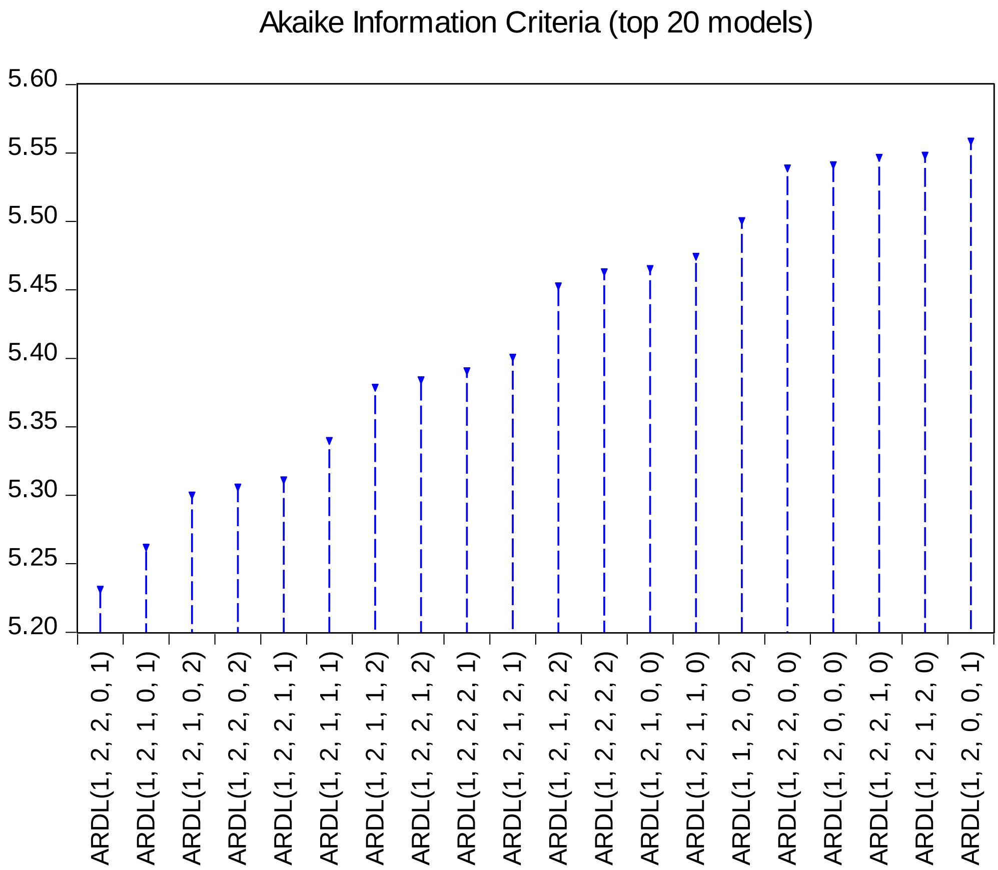
Table 6 Determining the Autoregressive Lag Length

Panel A Criteria to find lag-length in a VAR model						
Lag	Log L	LR	FPE	AIC	SC	HQ
0	-663.2764	NA	1.46	51.4058	51.6478	51.4755
1	-572.4864	139.6769*	9.6300*	46.3451*	47.7967*	46.7631*
Panel B. Johansen maximum eigenvalue test						
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**		
None *	0.880715	112.9124	69.81889	0.0000		
At most 1 *	0.598726	59.75640	47.85613	0.0026		
At most 2 *	0.542543	36.92863	29.79707	0.0064		
At most 3 *	0.412767	17.37684	15.49471	0.0257		
At most 4 *	0.150187	4.068480	3.841466	0.0437		
Panel C. Order of optimal lags (p, q, r, s, w)						
Specification	AIC*	HQ	Specification	AIC*	HQ	
(1, 2, 2, 0, 1)	5.231436	5.380184	(1, 1, 1, 0, 1)	5.757142	5.878845	
(1, 2, 1, 0, 1)	5.262194	5.39742	(1, 1, 2, 2, 1)	5.762333	5.924603	
(1, 2, 1, 0, 2)	5.300167	5.448915	(1, 1, 0, 1, 1)	5.76851	5.890213	
(1, 2, 2, 0, 2)	5.306028	5.468299	(1, 1, 0, 2, 2)	5.77022	5.918968	
(1, 2, 2, 1, 1)	5.311242	5.473513	(1, 2, 0, 2, 2)	5.770781	5.933052	
(1, 2, 1, 1, 1)	5.340001	5.48875	(1, 1, 1, 1, 2)	5.773246	5.921995	
(1, 2, 1, 1, 2)	5.379004	5.541275	(1, 0, 0, 0, 1)	5.773356	5.868014	
(1, 2, 2, 1, 2)	5.384294	5.560087	(1, 1, 2, 1, 0)	5.78361	5.918836	

(1, 2, 2, 2, 1)	5.390891	5.566684	(1, 0, 1, 0, 0)	5.788215	5.882873
(1, 2, 1, 2, 1)	5.400971	5.563242	(1, 0, 0, 1, 0)	5.791229	5.885887
(1, 2, 1, 2, 2)	5.452892	5.628685	(1, 1, 1, 1, 0)	5.797152	5.918855
(1, 2, 2, 2, 2)	5.463196	5.652512	(1, 1, 1, 2, 2)	5.802739	5.96501
(1, 2, 1, 0, 0)	5.465646	5.587349	(1, 1, 0, 2, 0)	5.804091	5.925794
(1, 2, 1, 1, 0)	5.474511	5.609736	(1, 0, 0, 0, 2)	5.817347	5.925528
(1, 1, 2, 0, 2)	5.500665	5.649414	(1, 1, 2, 2, 0)	5.827495	5.976244
(1, 2, 2, 0, 0)	5.539056	5.674281	(1, 1, 1, 1, 1)	5.836571	5.971796
(1, 2, 0, 0, 0)	5.541398	5.649579	(1, 1, 0, 2, 1)	5.840933	5.976159
(1, 2, 2, 1, 0)	5.546856	5.695604	(1, 0, 0, 1, 1)	5.849308	5.957489
(1, 2, 1, 2, 0)	5.548441	5.697189	(1, 0, 1, 0, 1)	5.852805	5.960986
(1, 2, 0, 0, 1)	5.558626	5.680329	(1, 0, 0, 2, 0)	5.853394	5.961574
(1, 1, 2, 1, 2)	5.575809	5.73808	(1, 0, 2, 0, 0)	5.867589	5.97577
(1, 2, 2, 2, 0)	5.602516	5.764787	(1, 0, 1, 1, 0)	5.868196	5.976377
(1, 2, 0, 0, 2)	5.613994	5.749219	(1, 1, 1, 2, 0)	5.876573	6.011799
(1, 1, 2, 0, 1)	5.615282	5.750508	(1, 0, 0, 1, 2)	5.879471	6.001174
(1, 2, 0, 1, 0)	5.619187	5.74089	(1, 0, 1, 0, 2)	5.897262	6.018965
(1, 2, 0, 1, 1)	5.625522	5.760748	(1, 1, 1, 2, 1)	5.899519	6.048267
(1, 1, 0, 0, 2)	5.643465	5.765168	(1, 0, 0, 2, 1)	5.911298	6.033001
(1, 1, 0, 0, 0)	5.65569	5.750348	(1, 0, 1, 1, 1)	5.926857	6.04856
(1, 1, 2, 2, 2)	5.65571	5.831504	(1, 0, 2, 0, 1)	5.930381	6.052085
(1, 2, 0, 2, 0)	5.684665	5.81989	(1, 0, 1, 2, 0)	5.932581	6.054285
(1, 1, 0, 0, 1)	5.688683	5.796864	(1, 0, 0, 2, 2)	5.940748	6.075974
(1, 2, 0, 1, 2)	5.691599	5.840347	(1, 0, 2, 1, 0)	5.947529	6.069232
(1, 1, 2, 1, 1)	5.691884	5.840632	(1, 0, 1, 1, 2)	5.955822	6.091047
(1, 2, 0, 2, 1)	5.705136	5.853884	(1, 0, 2, 0, 2)	5.976622	6.111847
(1, 1, 1, 0, 2)	5.712237	5.847462	(1, 0, 1, 2, 1)	5.990785	6.126011
(1, 0, 0, 0, 0)	5.71232	5.793455	(1, 0, 2, 2, 0)	5.991922	6.127147
(1, 1, 0, 1, 2)	5.714884	5.85011	(1, 0, 2, 1, 1)	6.004693	6.139919
(1, 1, 0, 1, 0)	5.724099	5.832279	(1, 0, 1, 2, 2)	6.01964	6.168389
(1, 1, 2, 0, 0)	5.730069	5.851772	(1, 0, 2, 1, 2)	6.035644	6.184393
(1, 1, 1, 0, 0)	5.735014	5.843195	(1, 0, 2, 2, 1)	6.039829	6.188577
			(1, 0, 2, 2, 2)	6.081642	6.243913

HQ: Hannan-Quinn criterion (HQC) (Hannan and Quinn 1979).

Figure 5 Akaike Information Criteria



According the Fig.5, the form becomes ARDL(1,2,2,0,1). Moreover, the results show that the model has no autocorrelation problem of the residual using Statistic-hs Durbin instead of Statistic-DW because it is misleading in the autoregressive models, since its statistical value is 93.0, which makes us accept H_0 because there is no problem of sequential autocorrelation of residuals.

On the other hand, to verify co-integration of the model's variables, the bound test methodology has been used in Table 7.

Table 7 ARDL Bounds Test

F-statistic K=4	Lower at 5%	Upper at 5%	Lower at 10%	Upper at 10%
12.070	2.56	3.49	2.2	3.09
Wold-statistic	11.93			

Source: Critical values taken from: Bounds testing, M .H Pesaran, Y Shin and R J. Smith. Table CI (ii) case II: Journal of Applied Econometrics (2001) relationships unrestricted intercepts and no trend.

Table 7 shows that the calculated F-statistic (12.07) is significant at 1% significance level. This means that the basic hypothesis of the lack of co-integration cannot be accepted even at a significant level of 10%, therefore, there co-integration exists between studied variables. Statistical calculations also show that calculated F-statistic (12.07) is significant at 1% significance level. This means that the basic hypothesis (that states lack of co-integration) cannot be accepted even at 1% significance level; therefore, there is co-integration between the variables. Since there is co-integration between variables, this integration shows long-term relation among variables, which can be expressed by the Eq. 6.

$$GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_i (GDP)_{t-i} + \sum_{i=0}^{q} \Phi_i (TRB)_{t-i} + \sum_{i=0}^{m} \varphi_i (OILP)_{t-i} + \sum_{i=0}^{n} \gamma_i (TRO)_{t-i} + \sum_{i=0}^{s} \vartheta_i (IMP)_{t-i} + \varepsilon_t \quad (6)$$

Table 8 The Estimation Of Long-Term Transactions According To ARDL Methodology

Variables	Coefficients	Std. Error	t-Statistic	Probability
IMP	0.328596	0.526135	0.624546	0.5423
OILP	0.290799	0.156832	1.854205	0.0849
TRB	0.000832	0.000100	8.337977	0.0000
TRO	-0.231678	0.070913	-3.267071	0.0056
C	32.404659	2.502377	12.949554	0.0000

According to the Table 7, the optimal standard formula for the model is:

$$GDP = 0.3286^{*} IMP + 0.2908\, OILP + 0.0008\, TRB - 0.231^{*} TRO + 32.4047 \quad (7)$$

Economically, oil prices and GDP are positively related, which agrees with the economic theory and the outcome we obtained using Eq. 7 when the oil price increases by $1, GDP will increase by $0.29.

3.7. Error Correction Model According to ARDL Methodology

When the long-term relation has been found using the co-integration model, we use the ECM model, which captures the short-term relation between dependent and interpreted variables with the help of the Eq. 8.

$$\Delta(GDP)_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta(GDP)_{t-i} + \sum_{i=0}^{q} \Phi_i \Delta(TRB)_{t-i} + \sum_{i=0}^{m} \varphi_i \Delta(OILP)_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta(TRO)_{t-i} + \sum_{i=0}^{s} \vartheta_i \Delta(IMP)_{t-i} + \psi ECT_{t-1} + \upsilon_t \quad (8)$$

When the ECM model is estimated with the help of ARDL (1,1,0,0,1) methodology according to the SBC standard, short-term elasticities (coefficients) are obtained as shown in Table 9.

Table 9 Short-Term Estimations and Error Correction

Variables	**Coefficients**	**Std. Error**	**t-Statistics**	**Prob.**
D(IMP)	1.365284	0.130865	10.43276	0.0000
D(IMP(-1))	-0.696872	0.147461	-4.725816	0.0003
D(OILP)	0.252059	0.038793	6.497481	0.0000
D(OILP(-1))	-0.158615	0.034261	-4.629582	0.0004
D(TRO)	-0.431010	0.056687	-7.603307	0.0000
ECT(-1)*	-0.683398	0.068933	-9.913901	0.0000
R-squared	0.984728	Mean dependent var		-0.030000
Durbin-Watson stat	2.305399			
Diagnostic tests				
h-Statistic	CHSQ (P-value)		CHSQ (P-value)	
A: AR (1)*	0.756579		0.40	
B: RESET **	0.654323		0.5243	
C: Norm ***	2.0898		0.5343	
D: hetro. ****	1.063563		0.4459	

Note: ***at 1% significance level. Dependent variable: D (GDP).

A correction coefficient (ECM) indicates the adjustment speed of long-term equilibrium, which is the correction rate's estimated parameter in the equation that represents economic growth (0464.1), which is significant but negative at significance level less than 0.05. This shows the ability of the oil prices to correct the imbalance caused by the instability of the time series of the study variables, which amounted to 6.10%.

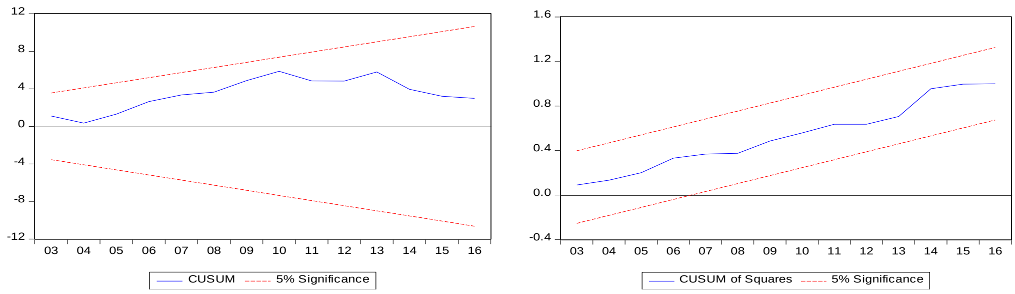
$$D(GDP) = 0.25D(OILP) - 0.34D(TRO) + 1.36^{*}D(IMP) \quad (9)$$

The value of the error correction coefficient indicates that the value of GDP is adjusted to the value of equilibrium for every time period through imbalance percentage remaining for the previous year, which is equivalent to 25%. The increase in one unit of variable D(oil(-1)) leads to an increase in GDP by 25%.

3.8. Diagnostic test results

Diagram of the statistic of the two tests (CUSUM and CUSUMSQ) of this model shows critical limits at 0.5 significance level 0.5. It is clear through the two forms that estimated ARDL coefficients have structural stability for the studied time period, which confirms the stability between the variables of the study and consistency in the model between the results of error correction both in long and short run.

Figure 6 Plots of Residuals CUSUM and CUSUMSQ



3.9. Causality Test

In this causality by Granger (1969) test, the relationship between two variables has been explored, i.e. whether these two variables affect each other (reciprocal relationship) or mono (in one direction), or the absence of this causal relationship. Therefore, the test shows, for example, that X is causing or affecting (Y), which is found using Fisher's test.

Table 10 VAR Granger Causality

Dependent variable (GDP)			
Excluded	**Chi-sq**	**Df**	**Prob.**
IMP	2.643504	1	0.1040
OILP	2.999846	1	0.0833
TRB	0.000118	1	0.9913
TRO	0.872861	1	0.3502
Dependent variable (OILP)			
GDP	4.760471	1	0.0291**
IMP	5.206834	1	0.0225**
TRB	1.736608	1	0.1876
TRO	6.370447	1	0.0116***

***, ** and * indicate a significant 1%, 5%, and 10%, respectively.

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \vartheta_i Y_{t-i} + \sum_{i=0}^{q} \delta_i X_{t-i} + \varepsilon_t \qquad (10)$$

Where both represent and δ are variable coefficients, which indicate p, q-showing lag of those variables and ε represents the random error limit.

Table 11 The VECM Granger Causality Analysis

VEC Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: D(GDP)			
Excluded	Chi-sq	df	Prob.
D(IMP)	1.703529	1	0.1918
D(OILP)	14.78772	1	0.0001
D(TRB)	0.440239	1	0.5070
D(TRO)	0.016091	1	0.8991
Dependent variable: D(IMP)			
D(GDP)	0.381655	1	0.5367
D(OILP)	48.94443	1	0.0000
D(TRB)	0.022147	1	0.8817
D(TRO)	5.110288	1	0.0238
Dependent variable: D(OILP)			
D(GDP)	9.234337	1	0.0024
D(IMP)	2.473937	1	0.1157
D(TRB)	6.961334	1	0.0083
D(TRO)	3.055034	1	0.0805
Dependent variable: D(TRB)			
D(GDP)	0.726367	1	0.3941
D(IMP)	1.361787	1	0.2432
D(OILP)	6.590814	1	0.0103
D(TRO)	0.097625	1	0.7547
Dependent variable: D(TRO)			
D(GDP)	0.067459	1	0.7951
D(IMP)	2.103974	1	0.1469
D(OILP)	4.610334	1	0.0318
D(TRB)	0.031811	1	0.8584

$$D(GDP) = -0.43(GDP(-1) + 5.62IMP(-1) - 2.47OILP(-1) + 0.0007TRB(-1) - 0.267TRO(-1) - 5.56825743229\ ) + 0.56D(GDP(-1)) - 1.18D(IMP(-1)) - 0.83D(OILP(-1)) - 0.0004D(TRB(-1)) + 0.039D(TRO(-1)) + 1.89$$

$$D(IMP) = -0.24(GDP(-1) + 5.62IMP(-1) - 2.47OILP(-1) + 0.0007TRB(-1) - 0.26TRO(-1) - 5.56) + 0.08D(GDP(-1)) + 0.79D(IMP(-1)) - 0.39D(OILP(-1)) - 2.73D(TRB(-1)) - 0.18D(TRO(-1)) + 1.05$$

$$D(OILP) = -0.091(\ GDP(-1) + 5.62IMP(-1) - 2.47OILP(-1) + 0.0007TRB(-1) - 0.26TRO(-1)\ 5.56) +\ 2.40D(GDP(-1)) - 2.04D(IMP(-1)) - 0.22D(OILP(-1)) - 0.002D(TRB(-1)) + 0.77D(TRO(-1)) + 0.54$$

$$D(TRB) = -249.22(\ GDP(-1)\ +\ 5.62IMP(-1) - 2.47OILP(-1) + 0.0007TRB(-1) - 0.267TRO(-1) - 5.56) + 383.70D(GDP(-1)) - 864.34D(IMP(-1)) - 456.52D(OILP(-1)) - 0.39D(TRB(-1)) + 79.11D(TRO(-1)) + 687.85$$

$$D(TRO) = -0.28\,(GDP(-1) + 5.62IMP(-1) - 2.47OILP(-1) + 0.0007TRB(-1) - 0.26TRO(-1) - 5.56) + 0.152D(GDP(-1)) + 1.40D(IMP(-1)) - 0.49D(OILP(-1)) - 0.0001D(TRB(-1)) - 0.140D(TRO(-1)) + 2.006$$

The results reported in Table-10 indicate that in the short run, unidirectional causal relationship is found between oil prices and (economic growth, Imports, and trade openness). The unidirectional causal relation is running from oil prices to economic growth, Imports, and trade openness. oil prices Granger causes economic growth. The statistically significance of joint long-and-short run causality corroborates our long run and short run causal relationships between the series over the study period of 1990-2016.

3.10 .Results of Variance Components

Table 12 Analysis of (VAR)

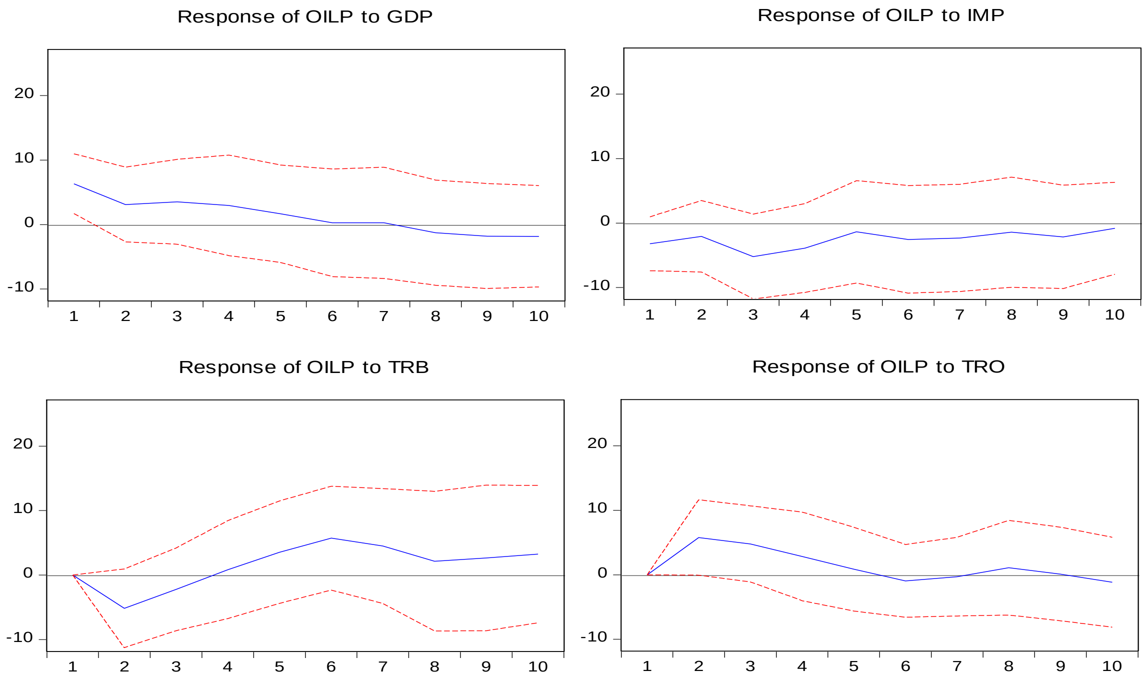
Period	S.E.	GDP	IMP	OILP	TRB	TRO
1	12.42589	25.88481	6.724500	67.39069	0.000000	0.000000
2	16.18782	18.91407	5.577179	52.70768	10.09388	12.70719
3	20.22347	15.15288	10.19523	53.24519	7.672584	13.73411
4	23.61766	12.68539	10.17910	59.86432	5.754316	11.51687
5	25.67151	11.16560	8.898684	63.28731	6.782805	9.865599
6	28.42585	9.114996	8.056693	65.08133	9.587750	8.159234
7	31.62932	7.368872	7.043029	69.21875	9.769475	6.599876
8	33.55995	6.688078	6.434627	71.82324	9.085261	5.968794
9	35.32764	6.295077	6.179364	73.37480	8.763353	5.387405
10	36.61659	6.108457	5.802360	74.03060	8.942706	5.115880

Since the changes in oil prices account for 25% of the variation in expected GDP growth in the first period, and their explanatory capacity declines over time to about 6% by the end of the tenth period. In addition, the GDP variable has no explanatory power to explain the variance of the variable of oil prices during the first period. Therefore, 67% variance was explained by the same variable, but this ratio increases to about 74% at the end of the tenth period. This result confirms the short-term causal relationship that moves from oil price growth to economic growth, which the study found while testing the Granger causality.

3.11. Impulse Response Functions (IRF)

IRFs were estimated using the VAR model to measure and analyze the vulnerability of GDP to different shocks in other variables, the variable itself, and the time span until their impact faded over a period of one to ten years reflecting the short term-long term differences. For studying effects oil price shocks on the economic growth, we have used impulse response function analysis. Fig. 7 depicts the IRFs of both the GDP (trade balance; imports; trade openness; crude oil price) and the shock of one general deviation in GDP.

Figure 7 Impulse response functions results over 10 years (% deviation from baseline)



Notes: Dotted red line (---) = standard error bands, Blue line (---) = IRF.

Oil price shock (OILP)

From Figure 7, the oil price shocks have a definitive impact on a country's GDP because it is one of the most stable shocks for the economy that has both positive and negative effects, while the positive impact is clear, which is significantly reduced in the low response coefficient approaching zero at 6 and negative impact after year 7 and also in the long term. The results of Fig. 5 show the impact of oil prices on imports, which is slightly negative at a decreasing rate until the tenth year. It almost ends after the 10th year and in the long-run. The oil prices have a negative effect on trade balance until the 4th year, which reaches its lowest level in the second year, and then becomes positive after the fourth year and in the long term as well. In addition, the shocks in oil prices have positive impact on trade openness until the 5th year, which means that the increase in the ratio of exports to imports leads to higher oil prices until the end of the period. Due to the close correlation between the Libyan economy and oil revenues. This fluctuation is due to the continuous fluctuations in oil revenues, which are volatile due to the volatility of international prices, which explains Libya's inability so far to raise the challenge of decoupling the Libyan economy and its growth from oil revenues, making it open and potentially confrontational in various external shocks.

5. CONCLUSION

While the oil supply is of great importance for the Libyan economy in the short term, new developments in the energy sector and technology and the emergence of alternative products will reduce the demand for oil, and in the long term, different growth sources of the Libyan economy will be needed.

The increase in oil prices increases the economy of oil in Libya and pushes oil-exporting countries to find alternative products and R & D in this field as it is a costly resource and this won't take long. Its importance is highlighted by studying and analyzing the effects of fluctuations in the international prices of oil on certain macroeconomic indicators of Libya such as GDP and imports for the period 1990-2016. The results of the stability test showed instability of most variables at the level I(0), but are stable when the first differences I(1) are taken. In addition to the results of the cointegration approach, (ARDL-bound testing approach) showed an integrative relationship between the crude oil prices and the GDP. Moreover, when the oil prices increased by $1, the GDP increased by $0.29. In economic terms, the results show that the relation between independent variables and the dependent variable (GDP) is both positive and has consistency with the economic theory. Finally, this study moved towards causality test results and established causal relation among oil prices (independent variable), GDP, imports and trade openness (dependent variables). The results indicate that in the short run, unidirectional causal relationship is found between oil prices and (economic growth, Imports, and trade openness). The unidirectional causal relation is running from oil prices to economic growth, Imports, and trade openness. oil prices Granger causes economic growth. The study concluded with many recommendations such as diversification of sources of income in Libya and encouragement of other economic sectors. Human and natural resources in Libya can contribute towards formation of GDP. There is a need to take advantage of the oil wealth through the processing of crude oil and converting that oil into derivatives rather than exporting it in the raw form because it will help obtaining large amounts of capital that can be used to achieve economic growth of the national economy.

Disclosure Statement

No potential conflict of interest was reported by the authors.

REFERENCES

Aimer, N. M. M. (2016): "The effects of fluctuations of oil price on economic growth of Libya". *Energy economics letters*, *3*(2), 17-29.

Aimer, N. M. M. (2017): "The effects of oil price volatility on the economic sectors of Libya". *International Journal of Business and Social Research*, 6(12), 13-24.

Akaike, H. (1973) "*Information theory and an extension of the maximum likelihood principle*" in 2nd International Symposium on Information Theory by B. N. Petrov and F. Csaki, eds., Akademiai Kiado: Budapest.

Akpan, E. O. (2009): "Oil price shocks and Nigeria macro economy". In *A Paper Presented at the Annual Conference of CSAE Conference, Economic Development in Africa, March*, 22-24.

Bernanke, B. S. (1983): "Irreversibility, uncertainty, and cyclical investment". *The Quarterly Journal of Economics*, *98*(1), 85-106.

Bernanke, B. S., Gertler, M., Watson, M., Sims, C. A., & Friedman, B. M. (1997): "Systematic monetary policy and the effects of oil price shocks". *Brookings papers on economic activity*, *1997*(1), 91-157.

Blanchard, O. J., & Gali, J. (2007): "*The Macroeconomic Effects of Oil Shocks: Why are the 2000s so different from the 1970s?*" (No. w13368). National Bureau of Economic Research.

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

Chang, Y., & Wong, J. F. (2003): "Oil price fluctuations and Singapore economy". *Energy policy*, *31*(11): 1151-1165. https://doi.org/10.1016/S0301-4215(02)00212-4

Das, S., Bose, S., & Bhanumurthy, N. R. (2014): "Oil Price Shock, Pass-Through Policy and its Impact on India". In *Market, Regulations and Finance*, 231-253.

Dickey, D. A., & Fuller, W. A. (1981): "Likelihood ratio statistics for autoregressive time series with a unit root". *Econometrica: Journal of the Econometric Society*, 1057-1072.

Esen, Ö. (2016). Security of the energy supply in Turkey: Prospects, challenges and opportunities. International Journal of Energy Economics and Policy, 6(2), 281-289.

Esen, Ö., & Bayrak, M. (2015). Examining on the Determinants of Energy Deficit from Theoretical Perspectives. Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 3(1), 45-61.

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

Finn, M. G. (2000): "Perfect competition and the effects of energy price increases on economic activity". *Journal of Money, Credit and banking*, 400-416.

George, D. (2011): "*SPSS for windows step by step: simple study guide and reference, 17.0 update, 10/e".* Pearson Education India.

Granger, C. W. (1969): "Investigating causal relations by econometric models and cross-spectral methods". *Econometrica: Journal of the Econometric Society*,424-438.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016): *A primer on partial least squares structural equation modeling (PLS-SEM).* Sage Publications.

Hamilton, J. D. (1983): "Oil and the macroeconomy since World War II". *Journal of political economy*, *91*(2), 228-248.

Hamilton, J. D. (2011): *Historical oil shocks* (No. w16790)". National Bureau of Economic Research.

Hannan, E. J. and B.G. Quinn (1978) "*The determination of the lag length of an autoregression*" Journal of Royal Statistical Society 41, 190 – 195.

Hooker, M. A. (1996): "What happened to the oil price-macroeconomy relationship?". *Journal of monetary Economics*, *38*(2), 195-213.

Jiménez-Rodríguez, R., & Sánchez, M. (2005): "Oil price shocks and real GDP growth: empirical evidence for some OECD countries". *Applied economics*, *37*(2), 201-228.

Johansen, S., (1988): *Statistical analysis of cointegrating vectors. Journal of Economic Dynamics and Control*, 12, 231-254.

Jumah, A., & Pastuszyn, G. (2007): *Oil price shocks, monetary policy and aggregate demand in Ghana.* (No. 212). Reihe Ökonomie/Economics Series, Institut für Höhere Studien (IHS).

Liew, K.S. (2004) *"Which lag length selection criteria should we employ?"* Economics Bulletin 3(33), 1- 9.

Merrill, K. R. (2007). *The Oil crisis of 1973-1974: a brief history with documents.* Bedford/St. Martin's.

Olomola, P. A., & Adejumo, A. V. (2006): "Oil price shock and macroeconomic activities in Nigeri". *International Research Journal of Finance and Economics*, *3*(1), 28-34.

Oriakhi, D. E., & Osaze, I. D. (2013). Oil price volatility and its consequences on the growth of the Nigerian economy: An examination (1970-2010). *Asian Economic and Financial Review*, *3*(5), 683.

Pesaran, H. H., & Shin, Y. (1998): "Generalized impulse response analysis in linear multivariate models". *Economics letters*, *58*(1), 17-29.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001): "Bounds testing approaches to the analysis of level relationships". *Journal of applied econometrics*, *16*(3), 289-326.

Phillips, P. C., & Perron, P. (1988): "Testing for a unit root in time series regression".*Biometrika*, *75*(2), 335-346.

Rasche, R. H., & Tatom, J. A. (1977). The effects of the new energy regime on economic capacity, production, and prices. *Federal Reserve Bank of St. Louis Review*, *59*(4), 2-12.

Rasche, R. H., & Tatom, J. A. (1977): "Energy resources and potential GNP". *Federal Reserve Bank of St. Louis Review*, (Jun), 10-24.

Reinsel, G.C., Ahn, S.K., (1992): *Vector autoregressive models with unit roots and reduced rank structure: estimation, likelihood ratio test, and forecasting*. Journal of Time Series Analysis, 13, 353-375.

Rogoff, K. (2006): "Oil and the global economy". *Manuscript, Harvard University*.

Rotemberg, J. J., & Woodford, M. (1996): *Imperfect competition and the effects of energy price increases on economic activity* (No. w5634). National Bureau of Economic Research.

Tatom, J. A. (1993): "Are there useful lessons from the 1990-91 oil price shock?". *The Energy Journal*, 129-150.

Van Eyden, R., Difeto, M., Gupta, R., & Wohar, M. E. (2019). Oil price volatility and economic growth: Evidence from advanced economies using more than a century's data. *Applied Energy*, *233*, 612-621.