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A Panel Data Application for the Relationships among Economic Growth, Oil Prices and Inflation in OPEC Countries*

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Abstract: This study examines the relations among economic growth, inflation and worldwide crude oil prices applying Dynamic Panel Data Approach. The relations of the selected 8 countries (Algeria, Ecuador, Gabon, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela) being the members of the Organization of the Petroleum Exporting Countries (OPEC) in terms of economic growth, inflation and real oil prices for the period 1968-2016 are assessed. Findings reveal that countries show cross section dependency in terms of the economic growth (EG) and real crude oil prices (LOP). Panel Unit Root Test results showing the existence of the Structural Breaks support the fact that the countries are affected by the world oil shocks in terms of the related variables. Result of panel cointegration test shows that there is a long-term relation among the variables of economic growth (EG), inflation (INF) and real crude oil prices (LOP). Further, panel causality test results support the one-sided causality relations from real crude oil prices to economic growth, from inflation to real crude oil prices and from economic growth to inflation.

Keywords: Oil Prices, Inflation, Economic Growth, OPEC countries, Panel Data Analysis

JEL Classification Numbers: C33, C19, C58, O57

1. Introduction

Crude oil is one of the goods of the world directing the economy and traded in the most intensive way. Oil known as dark gold in the finance markets and having an important role in the economy markets within industrial contexts today is from the production inputs that

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may positively and negatively affect the economic growth (Aarón and Nabiyev, 2009). Oil is accepted as an indispensable resource to fulfill the economic factors such as industrialization, economic growth and increasing the level of per capita income necessary for the realization of the economic development. Almost all economic activities are based on crude oil meeting approximately 40% of the total energy need of the world. Price per barrel of crude oil is assessed as the reference point affecting other energy markets. Oil is deemed as a resource that is demanded and used up and therefore; it could be efficient on other variables such as price volatility, share earnings, exchange rate, inflation rate and interest rate (Gómez-Loscoz et. al., 2012: 4575–4589). For this reason; the fluctuations in the global oil market and the differences in the crude oil prices and the usability of the oil reserves may also change the economic growth expectations of certain countries. The dependencies of the country economies on oil cause to many political problems from wars for the purpose of finding new oil resources to the important oil companies to demand to have a word in the domestic and foreign policies of the countries importing oil. Because of having important impacts also on the international relations, oil turns into a strategic trade material rather than being an ordinary industrial input (Yetkiner and Berk, 2008:12-14).

Oil has become one of the main elements determining the political developments in the last century in Middle East geography. While world oil industry was under the control of Rockefeller till the end of World War I; British Petroleum, Shell, Mobil, Exxon, Gulf, Texaco and Chevron (companies named after seven sisters) having a word in the market have been dominant today. The shares of the great companies in the sector have shown a decrease as a result of the developments such as the re-establishment of the balances in Middle East after World War II and nationalization of the oil resources in Iran (Bayraç, 2005: 5). The aforementioned seven companies cut their payments they make to the oil producer countries in 1959 and for this reason, the five countries (Venezuela, Iraq, Iran, Saudi Arabia and Kuwait) being oil producers and demanding to secure their income joined together and established the Organization of Petroleum Exporting Countries (OPEC) (Demir, 2008: 232). Oil prices making the impacts of the state economies on the macroeconomic variables felt depending on the supply fluctuations occurring together with World War II have been externally determined together with the establishment of the Organization of Petroleum Exporting Countries (OPEC) and has been a factor starting to make its destructive impacts felt in time (Burbidge and Harrison, 1984; Akıncıet.al., 2013). The efforts of the oil producer countries to have a word in the energy area together with the establishment of OPEC in 1960s gave an important result for the first time in 1973. An oil shock occurred together with the embargo implementation of OPEC countries to the oil prices continuing relatively stable from World War II to 1970s following Arabic-Israeli War occurring in 1973. World economy to enter into a highaccelerated growth process as of 1960s has increased the dependency on oil and therefore, increased the market share of OPEC. OPEC used its monopolist power between 1970-1980 and world economy experienced two great oil supply crises (1973-1974 and 1978-1979). As the first world oil shock; price per barrel of oil increased from 3,4 dollars to 13,4 dollars as a result of the prices rising depending on the first oil embargo implementation of OPEC in 1973-1974 period. Between the years 1978-1979; prices increased from 20 dollars to 30 dollars together with the experiencing of the impacts of the Iran revolution on the oil supply and the oil prices increased from 16 dollars to 26 dollars together with the third shockwave starting with the occupation of Kuwait by Iraq in 1990 (Dogrul and Soytas, 2010:1523-1525; Cunado and Gracia, 2003:137-139). One of the crises whose impact has been felt most in the world is 1999 shock during which oil prices per barrel increased from 12 dollars to 24 dollars (Cunado and Gracia, 2003:137-139; Akıncı et. al., 2013:349-351). During the period 2011-2014, oil prices ranged between 93-118 monthly on average. It reached 133$ being the highest level of 2000s in July 2008 before it decreased to the level of 61$ per barrel in December 2014 (Global Economic Prospects, 2015). The decision of OPEC for the protection of the production level indicated an important modification towards the protection of the market share rather than aiming an oil price range in the policy missions of the cartel. Change in oil prices from 1973 shock to today has become an important agenda item of both the countries in the region and other countries. This attitude of OPEC countries trying to solve all kinds of political, economic or military conflicts experienced with Western states by using the oil power at their hand caused the West to try to bring a new order to the industry in the period after 1980. Towards the end of 1980s, the fact that especially the free market economies have become a system preferred all over the world caused the power to slide from OPEC to the market in oil industry (Yetkiner and Berk, 2008: 12; Demir, 2008: 242-246). It was aimed to break the oil price determining power of both international oil companies and OPEC by aiming a more competitive oil market. However; this aim lasted too short, because this time, speculators and international investment funds took their place near the international oil companies and OPEC and started to play with the oil prices. Oil price occurs by itself in the international markets as of 1986. With the new mechanism, oil companies conduct forward transactions in the stock markets such as New York, London and Singapore concerning the oil they will produce. Oil market consists of both spot and derivative instruments. Oil having a depth in spot market has become an investment tool for the investors except for the manufacturer, transporter and refiner via the future transactions and stock markets in a short period of time (Yetkiner and Berk, 2008: 12).

The continuity of the decrease in oil prices means the decrease in input costs for the oil importing countries in short term. This situation is also expected to cause to positive impacts on inflation. Besides; because these importing countries will invest less foreign currency on oil, this situation causes to a positive impact on foreign trade balance and economic growth. When considered in terms of the oil exporting countries, decrease in demand may cause to negative impacts due to the fact that it will decrease the export of the countries trading with these countries. The continuity of the movement in decreasing direction in oil prices bears important risks in terms of Organization of Petroleum Exporting Countries (OPEC) and the Middle East economies with high dependency on oil. The decrease in oil prices causes to the recession of economies and this situation bears the potential for increasing political stability due to the decrease in public expenditure and increase in unemployment problem (ORSAM, 2014: 7-13).

The changes in oil prices firstly cause to wealth transfer between the oil importing countries and exporter countries. While the increases in oil prices increase the current account surplus in the exporting countries, the decrease in prices has negative impacts on the current accounts. The share taken by oil from GDP is also very high. Especially Kuwait, Libya, Iran and Saudi Arabia have an important place in the total oil goods and service amount. In this respect; while the increase in oil prices causes to the transfer of wealth to these countries from the importing countries and increase the economic growth, the decrease in oil prices forms an inverse impact.Because almost every sector in state economies is dependent on oil, the fluctuations in the oil prices concern the countries closely. The fluctuations in the oil prices affect the oil exporting and importing country economies differently. The increases in prices cause to a transfer of income from the oil importing countries towards oil exporting countries. While the increase in the prices causes to inflation, current deficit and budget deficits in the oil importing countries, economies of the oil exporting countries increase their real incomes due to the increases in export income together with the increase in prices, in contrast to the oil importing countries (Alagöz et. al., 2017: 145). Therefore; when considered in household terms, the increase in oil prices negatively affects the economic growth by decreasing the domestic demand as an element decreasing the real income. Although the increase in oil prices positively affects the oil exporting countries, inflation will increase in these countries in long term due to the increase in the oil prices. Moreover; the decrease of oil import due to the high price increases by the countries with alternative energy resources in the world will cause to the decrease in the export incomes of the oil exporting countries. In this way; national currency units will gain value, export will decrease and external deficit will occur (Akıncı et. al., 2013: 350-351). While the increase in prices causes to inflation, current deficits and budget deficits in the oil importing countries, economies of the oil exporting countries increase their real incomes due to the increase in export income together with the increase in the prices, in contrast to the oil importing countries (Alagöz et. al., 2017: 144-150). The existence of a relation between the oil prices and economic growth has become an important research subject due to the oil shocks leaving a lasting impression on the world economy and the stillnesses experienced after them.

There are many studies in the literature examining the volatility in oil prices and the changes between macroeconomic variables with various methods and reaching different results. Hamilton (1983) could be shown as the first one of the leading studies examining these relations. In his study, Hamilton examined the recessionist process in the USA in this process being a period in which oil shock occurring during World War II and 1973 was experienced and determined that the changes occurring in the oil prices cause to a causative impact on the total product level. In his studies, Hamilton (1983, 1996 and 2003) has asserted that the economic recession and the fluctuation in oil prices are closely related for the USA. As the findings of his studies, he has shown that the relation between current oil price and the US real GDP is significant and the impacts of the price changes on economy are asymmetrical.In his theoretical study, Bernanke (1983) has proven that companies to postpone the investments causes to lower total production when they have realized the increasing uncertainty in the issue of the oil prices in the future. Lee et. al., (1995) have shown the negative impacts of the increase in oil prices on the industrial production by examining the change in oil prices changing depending on time by using a generalized autoregressive conditional heteroscedasticity (GARCH). Ferderer (1996) has clearly shown that the instability caused by the oil price shocks may decrease the investment demands and this situation explains the existence of the negative correlation between oil prices and productivity and the existence of the positive correlation with inflation. In their study, Sauter and Awerbuch (2003) have examined the impacts of oil price movements for IEA (International Energy Agency) member countries on their economic and financial performance. Oil price volatility has been shown to have affected the economic activity more than the oil price level especially as of 1980s. In the study conducted by Guo and Kliesen (2005), oil price volatility has been measured according to New York Mercantile Exchange (NYMEX) data for the period 1984-2004 and it has been shown that the oil price volatility has a negatively significant impact on GDP growth.In his study in which he has analyzed the GDP and inflationist impact of the permanent increases in oil prices for short and long term for European Union countries, Roeger (2005) has reached the conclusion that price increases do not have significant inflationist impact, but they have impact in short term. Akide (2007) has examined the impacts of the oil price volatility on economic growth in Nigeria between 1970-2000 and shown that oil price shocks do not affect the economy of Nigeria. Adam and Tweneboah (2008) have examined the long and short term relations between global oil prices and money policy and shown the existence of long term connections.In the study conducted by Hamilton (2009), it has been shown that there is a negative relation between economy and crude oil prices in the USA. In the study conducted by Qianqian (2011), the impact of oil prices on Chinese economy has been examined with cointegration analysis and error correction model approach. The findings of the study show a long term balance relation between the oil prices and consumer price index, money policy and net export and have also presented the proof for the fact that the increasing oil prices cause to decrease in real growth.In the study conducted by Jo (2012); for the three-month period each between 1947-2008, the imported crude oil price (IRAC) has been used as an indicator for the world oil prices series and world industrial production index series has been used as an indicator for the world economic activity. The impacts of the crude oil prices have been econometrically examined with the regression model approach and VAR method. In his study in which he has examined the impact of oil price volatility on the economic growth of Pakistan with linear regression analysis for the period 1973-2011, Jawad (2013) has shown that the impact of the oil price volatility is not significant on gross domestic product.In the study conducted by Omojolaibi and Egwaikhide (2013), the impacts of the oil price dynamics have been analyzed on the economic performances of 5 countries (Algeria, Angola, Egypt, Libya and Nigeria) selected and exporting oil in Africa with the use of a panel vector autoregressive technique (PVAR) using 1990:Q1-2010:Q4 three-month each data. It has been shown in the findings that the macroeconomic performances of these countries are affected from oil price dynamics.

In the study conducted by Gökçe (2014) the changes possible to occur in the cost of the economic development have been assessed together with various data in the developments in the oil price and have been specified to be one of the indispensable inputs of economic development.In their study, Forgha et.al. (2015) have examined the impact of the price fluctuations in oil products on the economic growth for the period 1980-2013 for Cameroon. According to the results of the study in which they have applied Least Squares approach, oil product prices have a negative impact on interest rates, but a positive impact on economic growth. In their study, Lorusso and Pieroni (2015) have examined the impact of oil price fluctuations on the economy of the United Kingdom. Results have shown that the country deficit has decreased as a reaction to the increase in oil prices.In their study, Brini et. al. (2016) have examined the impacts of oil prices on inflation and the exchange rate changes for some of the MENA countries importing and exporting oil for the period 2000-2015 with structural VAR analysis approach. Their findings have shown that they have significant impacts on the real exchange rates of oil importing countries in long term. Alagöz et. al., (2017) have examined the impacts of oil prices on macroeconomic variables with panel data analysis using the data covering 1980-2016 period on annual basis for Turkey, China, South Africa, Mexico, Colombia, Costa Rica, Indonesia and Kazakhstan mentioned in a reportpublished by OECD in 2016, specified to be within the group of those with high income in 2030 and are similar to one another in economic level. According to the findings of the study, while 1-dollar increase in crude oil price causes to an increase by 0.04% on inflation throughout the examined countries, the increase in crude oil price has an effect within the direction of current deficit by having a negative impact on the current balance. Syzdykova (2018) has examined the impacts of oil price changes on the stock markets of BRIC (Brazil, Russia, India and China) countries using panel regression analysis and used the variables of oil prices, foreign exchange rate and share earnings. Findings of the study have shown that oil price changes and interest rates have a significant and negative impact on the share earnings of the countries and foreign exchange rate variable affects in positive direction.Many studies similar to these ones in the literature (Rasche and Tatom, 1977; Rasche and Tatom, 1981; Darby, 1982; Hamilton, 1983; Burbidge and Harrison, 1984; Santini, 1985; Gisser and Goodwin, 1986) have examined whether the recession periods in economy have been dependent on the shocks in oil prices. Most of these studies show proofs regarding the existence of a negative relation between oil prices and real production.

The contribution of the studies in the area of energy to the economy literature has recently increased very much. Energy economies have become the attraction center all over the world especially in the periods following 1973 oil shock. Within this context; oil that could be used in almost all sectors is deemed as one of the most important energy resources. The volatilities occurring in oil prices also cause to drastic changes in the total performance of state economies due to the fact that they not only affect the energy market, but they also affect the macroeconomic variables of the countries such as inflation, unemployment rate, income level and development. One of the indicators playing a strategic role in economy is “economic growth”. Economic growth shows the increase in the total amount of the goods and services in an economy and the output in the economy. Fluctuations in oil prices also affect the economic growths of the countries. Besides; the increase in the prices may cause to a decrease in total output of the country. Because it shows differences depending on the economic structures and development levels of the countries and also in terms of being in the oil importer and exporter position, analysis of the mentioned impacts is aimed with Panel Data Approach by selecting some of the OPEC member countries.

2. Material and Method

Panel data analysis provides opportunities for obtaining efficient results in the examination of the relations among variables, the expansion of the data set by taking the time and section dimension into consideration, increasing of the degree of freedom and decreasing the multiple linear connection possibility. A general panel data regression model could be shown as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + u_{it} \qquad (i = 1,\ldots,N \text{ and } t = 1,\ldots, T) \tag{1}$$

There are two important assumptions in the model. Homogeneity assumption expresses that β_1 coefficients are same for all sections in the panel and cross section independency expresses that a shock possible to occur in one of the cross sections does not affect other sections. Therefore; it is firstly necessary to test the validity of the mentioned two assumptions in panel data analyses.

2.1. Cross Section Dependency Test

Tests suggested by Breusch-Pagan (1980), Pesaran (2004) and Pesaran et.al. (2008) are used in the testing of cross section dependency. Pesaran (2004) has revised the LM test suggested by Breusch-Pagan (1980) in CD_{LM} test and developed two new tests. CD test which is valid both in $N>T$ and $T>N$ situations and has asymptotically standard normal distribution is as follows:

$$CD = \left(\frac{2T}{N(N-1)}\right)^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \tag{2}$$

CD test is valid in structural break and heterogeneous panel situations. $\hat{\rho}_{ij}$ coefficient in the equation no (2) is the correlation coefficient attained from the wastes of ADF regression (Pesaran, 2004: 9; Guloglu and Ivrendi, 2010: 384; Menyah et.al., 2014: 390). Pesaran et. al., (2008) have suggested the following LM_{adj} (Bias-Adjusted Cross Sectionally Dependence Lagrange Multiplier) test in which H_0 hypothesis that "cross section dependency is not existent" has been tested and deviation has been corrected due to the fact that Breusch-Pagan (1980) LM test is deviant for the little value of T;

$$LM_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T\hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2}{\sqrt{v_{Tij}^2}} \tag{3}$$

Here k shows the regressor number. v_{Tij}^2 shows the variance of $(T - k)\hat{\rho}_{ij}^2$. The test statistics attained according to this equation shows asymptotically standard normal distribution (Pesaran et. al., 2008, 108; Menyah et. al., 2014: 390). The following hypotheses are tested:

H_0: There is no cross section dependency.
H_1: There is cross section dependency.

According to the test results; the situation of the rejection of H_0 hypothesis means that there is no cross section dependency among the countries. First generation panel unit root tests are used in this situation. If H_0 hypothesis is rejected, it is detected that there is cross section dependency among the countries and second generation panel unit root tests are used (Baltagi, 2008: 284).

2.2. Panel Unit Root Test

The developed first generation panel unit root tests take as the basis the univariate time series stationary tests mainly as Im et. al., (1997), Maddala and Wu (1999), Hadri (2000), Choi (2001), Levin et. al., (2002). (Guloglu and Ivrendi, 2008: 2). On the contrary; O'Connell (1998: 16) has shown that the rejection possibility of the null hypothesis in panel unit root tests increases in the event of the existence of cross section dependency among the series. For this purpose; the unit root tests called as second generation in which cross section dependency is taken into consideration have been developed.

In this study, the stationarity of the series has been examined with CADF (Cross Sectionally Augmented Dickey Fuller) panel unit root test suggested by Pesaran (2007) and taking the cross section dependency into consideration. In this test, the standard ADF regression is expanded with the section averages of the first differences and delayed values of the cross sections. The mentioned unit root test could be used both in T>N and N>T situations and additionally, it ensures the examination of the stationarity for both cross section and all of the panel. The regression model of CADF test is as follows:

$$\Delta y_{it} = \alpha_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^{p} d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + e_{it} \quad (4)$$

In the model, $\bar{y}_t$ is the cross section average. Null hypothesis is within the direction that each cross section has unit root. Alternative hypothesis specifies that at least one of the cross sections is stationary. CIPS (Cross-Sectionally Augmented IPS) test statistics is attained for the panel with the division of the test statistics found for each cross section into N and test statistics are decided after comparison to Pesaran (2007) table values. CIPS test statistics is calculated as follows[1]:

$$CIPS = N^{-1} \sum_{i=1}^{N_i} t_i \quad (5)$$

2.3. Structural Break Unit Root Test (Carrion-I-Silvestre et. al., 2005)

In Carrion-i-Silvestre et. al. (2005) (PANKPSS-Panel Kwiatkowski, Phillips, Schmidt and Shin test) test, five ea. structural breaks are allowed and break dates are also internally

[1]For more information on CADF Panel Unit Root Tests, see Pesaran (2004 and 2007).

determined. The test is the developed figure of KPSS test in time series. PANKPSS test obtains the structural break points by using Bai and Perron (2003) algorithm, with the help of quasi-GLS method with dynamic programming process by minimizing the error sum of squares. This test could also be used in small samples (Carrion-i-Silvestre et. al., 2005). Carrion-i-Silvestre et. al. (2005) have developed five different test statistics[2]. The hypotheses of the test are as follows:

H_0: There is unit root under the structural breaks,
H1: There is no unit root under the structural breaks.

Carrion-i-Silvestre et al. (2005) assess the model given below:

$$y_{it} = \beta_{it} + \delta_i t + u_{i,t}\,, \qquad i=1,2,\dots,N \qquad t=1,2,\dots,T$$

$$\beta_{it} = \sum_{k=1}^{m_i} \varphi_{i,k} D(T^i_{b,k})_t + \sum_{k=1}^{m_i} \theta_{i,k} DU_{i,k,t} + \beta_{i,t-1} + \varepsilon_{i,t} \qquad (6)$$

In the equation (6), $D(T^i_{b,k})=1$ for $t = T^i_{b,k}+1$ and it is 0 in other conditions. $DU_{i,k,t}=1$ for $t>T^i_{b,k}$ andit is 0 in other conditions. If $T^i_{b,k}$, i^{th}cross section shows k^{th} break date for the cross section T. the asymptotic critical values necessary for testing the hypotheses could be produced with bootstrap. H_0 is rejected when the calculated test statistics is lower than the critical value. In this situation, it is accepted that there is no unit root under the structural breaks in the series, namely the series is stationary.

2.4. Panel Cointegration Test (Westerlund (2006))

When the series are not level stationary, it is necessary to examine the existence of the long term relation between the variables. Kao (1999), Pedroni (1999) could be shown as the examples for the cointegration tests developed for this purpose and in which cross section dependency is not taken into consideration and Westerlund (2006), Westerlund and Edgerton (2007) could be shown as the examples for the tests in which cross section dependency is taken into consideration. In this study, panel cointegration test developed by Westerlund (2006) allowing the stationary and trend structural break has been benefited. This method is statistically strong in the events of the internality problem among the variables and multiple linear connections and allows the breaks at different numbers and at different dates for each section. Also; test also takes the cross section dependency into consideration. Westerlund (2006) uses the following equation system for y_{it} variable having time and cross section dimension:

$$y_{it} = z'_{it}\gamma_{ij} + x'_{it}\beta_i + e_{it}; \quad e_{it} = r_{it} + u_{it}; \quad r_{it} = r_{it-1} + \phi_i u_{it} \qquad (6)$$

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[2]For more information on the stochastic data production process used in Carrion-i-Silvestre et. al., (2005) test, see: (Carrion-i-Silvestre et. al., 2009).

Here, $x_{it} = x_{it-1} + v_{it}$ is K-dimensional explanatory variable vector, z_{it} is the deterministic compounds vector and the index shown with j indicates the structural breaks of *j=1*, …, M_i+1 and occurs in the periods of T_{i1}, ..., T_iM_i. Structural break dates are attained from the data internally with the global minimization method of the residual sum of squares of Bai and Perron (1998). When:

$$\hat{T}_\ell = \text{argmin}_{T\acute{I}} \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}+1}^{T_{ij}} (y_{it} - Z_{it}^{'}\hat{\gamma}_{ij} - x_{it}^{'}\hat{\beta}_\ell)^2$$

$$\hat{\omega}_{i1,2}^2 = \hat{\omega}_{i1,1}^2 - \hat{\omega}_{i21}^{'}\hat{\Omega}_{i22}^{-1}\hat{\omega}_{i21} \text{ and } S_{it} \sum_{k=T_{ij-1}+1}^{t} \hat{e}_{ik}^{*} \tag{7}$$

Are defined with the equations no. (7), panel LM test statistics:

$$Z(M) \equiv \sum_{i=1}^{N} \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}+1}^{T_{ij}} (T_{ij} - T_{ij-1})^{-2} \hat{\omega}_{i1,2}^{-2} S_{it}^2 \tag{8}$$

DOLS or FMDOLS could be used in e_{ik} estimation. In the test; null hypothesis is as the fact that there is cointegration in all cross sections and the alternative hypothesis is as the fact that there is no cointegration in some sections. The critical values are attained from bootstrap distribution in the event of the existence of the cross section dependency.[3]

2.5. Panel Causality Test (Dumitrescu and Hurlin, 2012)

Causality test model developed by Dumitrescu and Hurlin (2012) has been used to examine the short term causality relations among the variables. In this method, fixed curve coefficients are separately calculated for each country. The test takes the heterogeneity among the countries into consideration and also takes the cross section dependency into consideration. The following hypotheses are tested in DumitrescuandHurlin (2012) method:

H_0: The variable y is not the reason for the variable x for all units.
H_1: The variable y is the reason for the variable x for some units.

Causality test model is defined for the stationary y and x variables as follows (Dumitrescu and Hurlin, 2012:1457):

$$x_{i,t} = \alpha_i + \sum_{k=1}^{k} \gamma_i^{(k)} x_{i,t-k} + \sum_{k=1}^{k} \beta_i^{(k)} y_{i,t-k} + e_{i,t}$$

$$y_{i,t} = \alpha_i + \sum_{k=1}^{k} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{k} \beta_i^{(k)} x_{i,t-k} + e_{i,t} \tag{9}$$

[3]For more information on multiple structural break panel unit root test, see Westerlund (2006).

Equation (9) is used to check whether variable x is the reason for variable y and this causality relation is easily tested using H0 hypothesis on the basis of an F test. Furthermore; in the event of the rejection of H_0 hypothesis, variables switch places and change the direction of the causality and two-sided causality relation could be observed (Lopez and Weber, 2017: 2).

3. Results Analysis: Relations among Inflation, Crude Oil Prices and Economic Growth for OPEC Countries

In the study, the annual data of 8 countries (Algeria, Ecuador, Gabon, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela) selected and being a member of the Organization of Petroleum Exporting Countries (OPEC) belonging to 1968-2016 data have been used. The data period used covers 1973-1974, 1979-1980 world oil shocks and 2008 global financial crisis periods. In the analysis; Brent crude oil price per barrel (Price in $ 2016) has been attained from https://www.quandl.com/ international database for the crude oil prices and the Gross Domestic Product (GDP) and Consumer Price Index (CPI) data have been attained from World Bank website (http://databank.worldbank.org/data/source/world-development-indicators). GDP data of the countries have been used as the indicator of economic growth (EG) and CPI data have been used as the indicator of inflation (INF). Real crude oil prices (LOP) have been included in the analysis by monitoring, (Katırcıoğlu et. al., 2015) and by proportioning the oil prices to the consumer price indexes of each country. Variables have been used with their logarithmic conversions and Stata-14 and Gauss-19 software items have been used in the analysis. Economic growth (EG), real crude oil prices (LOP) and inflation (INF) graphs of the countries are given respectively in Figure 1-3.

Descriptive statistics belonging to the variables are given place in Table 1.

Table 1: Descriptive Statistics

Variable	Observation	Mean	StandardDeviation	Min	Max
EG	392	3.4878	0.5384	1.9876	4.7448
LOP	392	0.5791	1.1130	-2.0281	3.3907
INF	392	1.0628	1.1563	-1.7851	3.6689

The cross section dependency test whose results are shown in Table 2 and 3 is calculated with four different test statistics. Cross section dependency test is separately assessed for the stationary and stationary+trend situations. The null hypothesis is rejected in Table 2 for the variables of economic growth (EG) and real crude oil prices (LOP). There is cross section dependency in both variables. In other words; there is a relation among the countries in terms of the variables of economic growth (EG) and real crude oil price (LOP) and the unit root tests taking cross section dependency into consideration are used.

Figure 1: EG of the Countries

Figure 2: LOP of the Countries

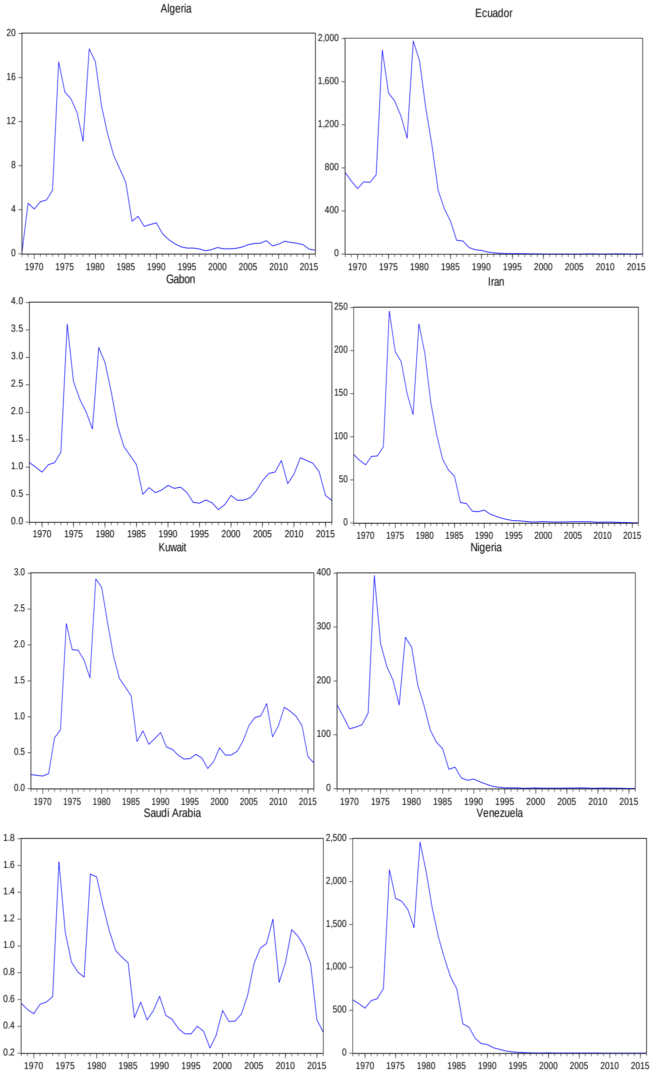

Figure 3: INF of the Countries

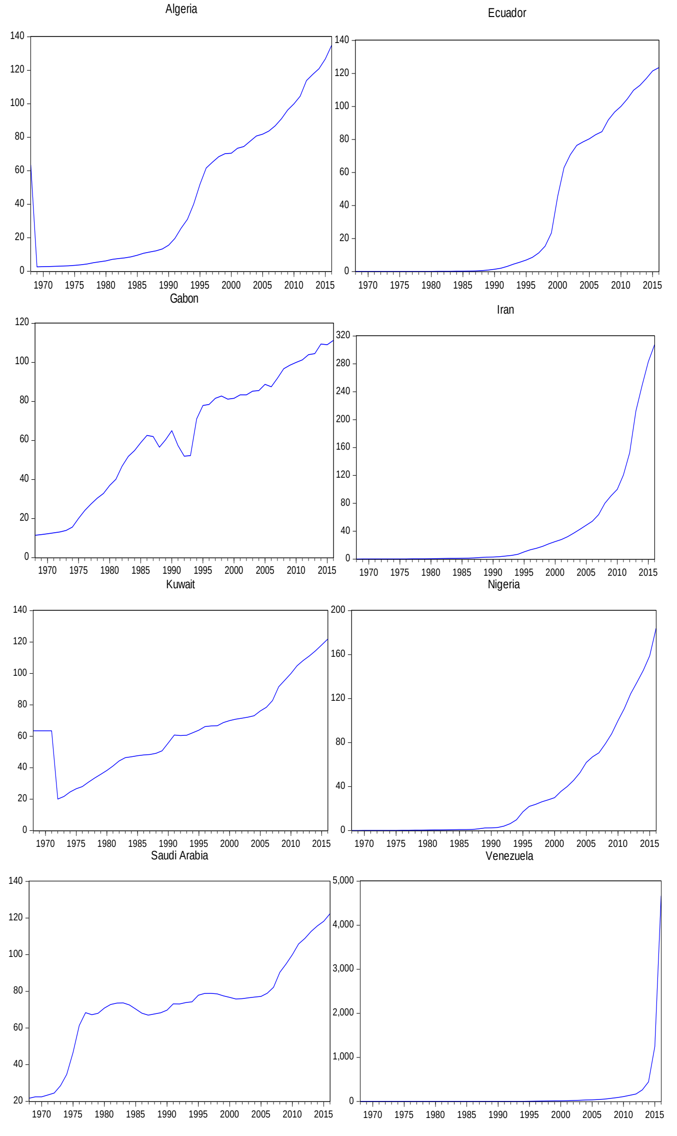

Table 2: Results of Cross Section Dependency Test (Stationary)

Test Statistics and Probability (Stationary)			
	EG	**LOP**	**INF**
CD_{LM1}	273.620* (0.000)	1070.030* (0.000)	35.324 (0.161)
CD_{LM2}	32.822* (0.000)	139.247* (0.000)	0.979 (0.164)
CD_{LM}	15.133* (0.000)	32.662* (0.000)	1.504*** (0.066)
Bias-adjusted CD_{AD}	151.661* (0.000)	157.932* (0.000)	128.885* (0.000)

Note: (i) H_0: No cross section dependency, (ii) *, ** and *** are respectively 1%, 5% and 10% significance levels. (iii) CD_{LM1} and CD_{AD} are the test statistics developed for cross section dependency respectively by Breusch and Pagan (1980) and Pesaran et. al. (2008). They are attained as $CD_{LM1} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}$ and $CD_{AD} = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{(T-k)\hat{\rho}_{ij}^2-\mu T_{ij}}{\nu T_{ij}}$. CD_{LM2} and CD_{LM} are the test statistics developed for cross section dependency by Pesaran (2004). They are shown as $CD_{LM2} = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2$ and $CD_{LM} = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}T\hat{\rho}_{ij}^2 - 1$.

The first three test statistics for inflation (INF) variable are higher than the critical values at the significance level by 5% and thereof, the null hypothesis cannot be rejected. In this respect; there is no cross section dependency in INF variable. It is convenient to use first generation panel unit root tests for the stationarity of the series with no cross section dependency.

Table 3: Results of Cross Section Dependency Test (Stationary+Trend)

Test Statistics and Probability (Stationary + Trend)			
	EG	**LOP**	**INF**
CD_{LM1}	258.016*** (0.000)	1036.094*** (0.000)	31.717 (0.286)
CD_{LM2}	30.737*** (0.000)	134.712*** (0.000)	0.497 (0.310)
CD_{LM}	14.603*** (0.000)	32.100*** (0.000)	1.144 (0.126)
Bias-adjusted CD_{AD}	127.771 (0.000)	153.214*** (0.000)	123.482*** (0.000)

Note: (i) H_0: No cross section dependency. (ii) *, ** and *** are respectively 10%, 5% and 1% significance levels. (iii) CD_{LM1} and CD_{AD} are the test statistics developed for cross section dependency respectively by Breusch and Pagan (1980) and Pesaran et. al. (2008). They are attained as $CD_{LM1} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}$ and $CD_{AD} = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{(T-k)\hat{\rho}_{ij}^2-\mu T_{ij}}{\nu T_{ij}}$. CD_{LM2} and CD_{LM} are the test statistics developed for cross section dependency by Pesaran (2004). They are shown as $CD_{LM2} = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2$ and $CD_{LM} = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}T\hat{\rho}_{ij}^2 - 1$.

Cross section dependency test results are given in Table 3 in stationary and trend situation. Results similar to those in Table 2 are reached for EG, LOP and INF variables.Table 4-7 includes unit root test results. These tables consist of Panel A, Panel B and Panel C parts. There are critical values related to Pesaran CADF statistics of each country forming the panel in Panel A part. There are critical values regarding the CIPS statistics of Pesaran for the panel data in Panel B part. There are Levin Lin and Chu (2002) and ImPesaran and Shin (2003) test statistics from first generation panel unit root tests in Panel C part.

Table 4: Unit Root Test Results (Constant)

Panel A: Individual CADF Test Statistics					
			Critical Values		
Countries	EG	LOP	0.90	0.95	0.99
Algeria	-2.9497	0.8309	-2.94	-3.29	-3.94
Ecuador	-1.9929	-1.8242	-2.94	-3.29	-3.94
Gabon	-1.6603	-2.2894	-2.94	-3.29	-3.94
Iran	-3.5726	0.1369	-2.94	-3.29	-3.94
Kuwait	-3.0814	-3.5832	-2.94	-3.29	-3.94
Nigeria	-1.0104	-1.6513	-2.94	-3.29	-3.94
Venezuela	-2.9093	2.8241	-2.94	-3.29	-3.94
Saudi Arabia	-2.6573	-2.1146	-2.94	-3.29	-3.94
Panel B: Panel CIPS Test Statistics					
	EG	LOP	Critical Values		
Test Statistics	-2.4793	-0.9589	0.90	0.95	0.99
			-2.21	-2.33	-2.55
Panel C: IstGeneration Panel Stationarity Tests					
	LLC		IPS		
INF	-0.4180** (0.0380)		1.9128** (0.0271)		

Note: (i) CADF and CIPS test statistics are the Unit Root Test statistics taking into consideration the cross section dependency derived by Pesaran (2007). CADF and CIPS test statistics are compared to the critical values of Pesaran (2007). (ii) Pesaran (2007) test hypotheses: H_0: There is unit root, H_a: There is no unit root (iii) *, ** and *** are respectively the 10%, 5% and 1% significance levels, (iv) LLC (Levin, Lin and Chu (2002)) and IPS (Im, Pesaran and Shin (2003)) are the first generation unit root tests not taking cross section dependency into consideration.

Pesaran CADF and CIPS test statistics have been calculated in Table 4 for the variables of economic growth (EG) and crude oil price (LOP). Because test statistics are lower than the critical values in terms of absolute value at 1% significance level, the null hypothesis expressing the existence of the unit root cannot be rejected. According to LLC and IPS test statistics for INF variable, the null hypothesis expressing the existence of unit root cannot be rejected. According to the findings of Table 4, EG, LOP and INF variables are not stationary.

Table 5: Unit Root Test Results (Constant+ Trend)

Panel A: Individual CADF Test Statistics					
			Critical Values		
Countries	EG	LOP	0.90	0.95	0.99
Algeria	-2.7470	-0.7062	-3.44	-3.78	-4.49
Ecuador	-2.5326	-1.1641	-3.44	-3.78	-4.49
Gabon	-1.6123	-3.6289	-3.44	-3.78	-4.49
Iran	-3.9132	-3.1509	-3.44	-3.78	-4.49
Kuwait	-3.5091	-4.2357	-3.44	-3.78	-4.49
Nigeria	-0.4731	-1.0528	-3.44	-3.78	-4.49
Venezuela	-2.9186	1.8256	-3.44	-3.78	-4.49
Saudi Arabia	-2.7499	-5.2352*	-3.44	-3.78	-4.49
Panel B: Panel CIPS Test statistics					
	EG	LOP		Critical Values	
Test Statistics	-2.5570	-2.1685	0.90	0.95	0.99
			-2.73	-2.84	-3.06
Panel C: IstGeneration Panel Stationarity Tests					
	LLC		IPS		
INF	-1.8495(0.03**)		-4.1893(0.00***)		

Note: (i) CADF and CIPS test statistics are the Unit Root Test statistics taking into consideration the cross section dependency derived by Pesaran (2007). CADF and CIPS test statistics are compared to the critical values of Pesaran (2007). (ii) Pesaran (2007) test hypotheses: H_0: There is unit root, H_a: There is no unit root (iii) *,** and *** are respectively the 10%, 5% and 1% significance levels, (iv) LLC (Levin, Lin and Chu (2002)) and IPS (Im, Pesaran and Shin (2003)) are the first generation unit root tests not taking cross section dependency into consideration.

Panel unit root test results with constant and trend are shown in Table 5 for EG, INF and LOP variables. According to CADF statistics, the mentioned variables are not stationary except for LOP variable for Saudi Arabia. CIPS statistics also shows that the variables are not stationary at 1% significance level. Because LLC and IPS test statistics are lower than 1% and 5% significance levels for INF variable, the null hypothesis expressing the existence of the unit root is rejected. According to the findings, INF variable is stationary while EG and LOP variables are not stationary when the trend of the variables is taken into account.

In Table 5, unit root tests are calculated again after taking the first difference of EG and LOP variables. According to CADF statistics in Table 6, EG variable is not stationary for Saudi Arabia. LOP variable is not stationary for the countries of Ecuador and Venezuela.

EG and LOP values have become stationary for all other countries. CIPS statistics shows that EG and LOP variables are stationary and LLC and IPS test statistics show that INF variable is stationary. According to the findings, the variables whose first difference has been taken are seen to be stationary in the constant situation.

Table 6: Unit Root Test Results (First Difference-Constant)

Panel A: Individual CADF Test statistics					
			Critical Values		
Countries	EG	LOP	0.90	0.95	0.99
Algeria	-5.0538***	-3.3195***	-2.94	-3.29	-3.94
Ecuador	-6.5486***	-2.5215	-2.94	-3.29	-3.94
Gabon	-4.0597***	-3.8582**	-2.94	-3.29	-3.94
Iran	-6.6166***	-4.7960***	-2.94	-3.29	-3.94
Kuwait	-3.6960**	-4.8199***	-2.94	-3.29	-3.94
Nigeria	-5.4207***	-3.7640**	-2.94	-3.29	-3.94
Venezuela	-4.2530***	0.0206	-2.94	-3.29	-3.94
Saudi Arabia	-2.6490	-4.1463***	-2.94	-3.29	-3.94
Panel B: Panel CIPS	**Test Statistics**				
	EG	LOP	Critical Values		
Test Statistics	-4.7872***	-3.4006***	0.90	0.95	0.99
			-2.21	-2.33	-2.55
Panel C: I[st] Generation Panel Stationarity Tests					
	LLC		IPS		
INF	-39.7696(0.00***)		-23.8920(0.00***)		

Note: (i) CADF and CIPS test statistics are the Unit Root Test statistics taking into consideration the cross section dependency derived by Pesaran (2007). CADF and CIPS test statistics are compared to the critical values of Pesaran (2007). (ii) Pesaran (2007) test hypotheses: H_0: There is unit root, H_a: There is no unit root. (iii) *, ** and *** are respectively the 10%, 5% and 1% significance levels, (iv) LLC (Levin, Lin and Clu) and IPS (Im, Pesaran and Shin) are the first generation unit root tests not taking cross section dependency into consideration.

In Table 7, the unit root test results are given by taking the constant+trend of the variables into consideration after taking the first difference of the variables. According to CADF statistics, EG variable is stationary. LOP variable is not stationary for Ecuador and Venezuela. EG and LOP values are stationary for all other countries for the first difference. CIPS statistics shows that EG and LOP variables are stationary and LLC and IPS test statistics show that INF variable is stationary. Generally, the variables whose first difference has been taken are stationary in the constant+ trend situations.

Table 7: Unit Root Test Results (First difference-Constant+Trend)

Panel A: Individual Stationarity Test CADF					
Countries	**EG**	**LOP**	**Critical values**		
			0.90	0.95	0.99
Algeria	-5.2426***	-3.8035**	-3.44	-3.78	-4.49
Ecuador	-6.5051***	-3.0307	-3.44	-3.78	-4.49
Gabon	-4.3726**	-4.2625**	-3.44	-3.78	-4.49
Iran	-6.5576***	-4.7262***	-3.44	-3.78	-4.49
Kuwait	-3.6375**	-5.0241***	-3.44	-3.78	-4.49
Nigeria	-7.3721***	-4.1467**	-3.44	-3.78	-4.49
Venezuela	-4.1814**	-0.8104	-3.44	-3.78	-4.49
Saudi Arabia	-3.6261*	-4.1564**	-3.44	-3.78	-4.49
Panel B: Panel Stationarity Test CIPS					
Test Statistics	-5.0619***	-3.7451***	**Critical values**		
			0.90	0.95	0.99
			-2.73	-2.84	-3.06
Panel C: IstGeneration Panel Stationarity Tests					
	LLC	IPS			
INF	-41.7384(0.0000***)	-24.4990(0.0000***)			

Note: (i) CADF and CIPS test statistics are the Unit Root Test statistics taking into consideration the cross section dependency derived by Pesaran (2007). CADF and CIPS test statistics are compared to the critical values of Pesaran (2007). (ii) Pesaran (2007) test hypotheses: H0: There is unit root, Ha: There is no unit root. (iii) *, ** and *** are respectively the 10%, 5% and 1% significance levels, (iv) LLC (Levin, Lin and Clu) and IPS (Im, Pesaran and Shin) are the first generation unit root tests not taking cross section dependency into consideration.

One of the reasons for the nonstationarity of the macroeconomic variables could be the structural breaks experienced by the countries and occurring due to certain reasons such as social and economic crises. These crises could be considered to have impacts on economic growth (EB), crude oil prices (LOP) and inflation (INF) being the economic indicators of the countries as a theoretical foresight. For this purpose; stationarity of the variables is tested with Carrion-i Silvestre et. al. (2005) being from the structural break unit root tests.

Test results are given in Table 8-14. Tables consist of Panel A, Panel B and Panel C parts. In Panel A, there are individual KPSS test statistics, break dates and related critical values for each country. In Panel B, there are PANKPSS test statistics of KPSS test statistics adapted to the panel. In Panel C part, there are the asymptotic and bootstrap critical values calculated under the homogeneity and heterogeneity assumptions of the long term variance in Panel B part.

Table 8: Structural Break Individual and Panel Unit Root (PANKPSS) Test Results (EG-Constant))

Panel A: Individual KPSS Test and Break Dates										
							Finite Sample Critical Values			
Countries	KPSS	m	Tb,1	Tb,2	Tb,3	Tb,4	0.90	0.95	0.975	0.99
Algeria	0.070	2	1974	2004	-	-	0.191	0.233	0.278	0.343
Ecuador	0.060	3	1974	2002	2009	-	0.215	0.273	0.355	0.468
Gabon	0.485	2	1974	2004	-	-	0.191	0.234	0.271	0.329
Iran	0.067	2	1974	2005	-	-	0.206	0.262	0.300	0.358
Kuwait	0.033	4	1974	1987	1994	2003	0.111	0.127	0.142	0.163
Nigeria	0.063	4	1974	1983	2002	2009	0.134	0.151	0.168	0.192
Saudi Arabia	0.061	2	1974	2004	-	-	0.190	0.237	0.278	0.345
Venezuela	0.077	2	1974	2005	-	-	0.200	0.249	0.300	0.363

Panel B: Panel Stationarity (PANKPSS) Tests		
	Test Statistics	**Prob.**
LM(λ) (hom)[a]	0.025	0.490
LM(λ) (het)[b]	2.744	0.003

Panel C: Asymptotic and Bootstrap Critical Values								
Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
LM(λ)(hom)[a]	-0.177	0.049	0.236	0.495	2.916	3.410	4.050	4.664
LM(λ)(het)[b]	-0.164	0.094	0.330	0.588	4.366	5.231	6.148	7.214

Note: (i) KPSS is Kwiatkowski, Phillips, Schmidt and Shin tests; m: is the number of structural breaks and $T_{b,i}$ is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

In Table 8, PANKPSS test is estimated in stationary situation for the variable of economic growth (EG). In Panel A, break dates at constant are shown for each country. There are break points at constant for EG variable. Test statistics of all countries except for Gabon are lower than the critical values. Null hypothesis expressing stationarity cannot be rejected. According to the findings, EG is level stationary for all countries.

In Panel B, the test statistics of long term variance calculated under the homogeneity and heterogeneity assumptions are shown for all OPEC countries. Test statistics are compared to the asymptotic and bootstrap critical values in Panel C. bootstrap critical values give reliable results under the conditions when classical statistical methods are insufficient. All test statistics are lower than the critical values (99%, 95% and 90%) and stationarity null hypothesis cannot be rejected. It is stationary at a changing level despite the breaks. When the break dates are examined, OPEC countries could be said to have been affected from the oil shock in 1974. Break points of the countries get more intense in 2002, 2003, 2004 and 2005.

Table 9: Structural Break Individual and Panel Unit Root (PANKPSS) Test Results (EG-Trend)

Panel A: Individual KPSS Test and Break Dates

							Finite Sample Critical Values			
Countries	**KPSS**	**m**	$\mathbf{T_{b,1}}$	$\mathbf{T_{b,2}}$	$\mathbf{T_{b,3}}$	$\mathbf{T_{b4}}$	0.90	0.95	0.975	0.99
Algeria	0.100	3	1981	1999	2009	-	0.168	0.207	0.237	0.275
Ecuador	0.106	3	1980	1987	1998	-	0.211	0.265	0.310	0.375
Gabon	0.030	2	1974	2004	-	-	0.197	0.250	0.305	0.357
Iran	0.043	2	1976	1992	-	-	0.204	0.254	0.296	0.355
Kuwait	0.045	3	1980	1994	2004	-	0.201	0.248	0.295	0.350
Nigeria	0.034	2	1982	1992	-	-	0.191	0.241	0.297	0.352
Saudi Arabia	0.052	2	1979	1987	-	-	0.183	0.228	0.273	0.333
Venezuela	0.190	4	1981	1988	2001	2009	0.199	0.248	0.296	0.373

Panel B: Panel Stationarity (PANKPSS) Tests

	Test Statistics	**Prob.**
LM(λ) (hom)[a]	5.984	0.000
LM(λ) (het)[b]	14.403	0.000

Panel C: Asymptotic and Bootstrap Critical Values

Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
LM(λ)(hom)[a]	2.377	2.743	3.210	3.900	14.183	17.416	20.281	24.520
LM(λ)(het)[b]	4.065	5.403	6.740	8.333	28.590	32.962	56.657	41.378

Note: (i) KPSS is Kwiatkowski. Phillips, Schmidt and Shin tests; m: is the number of structural breaks and Tb, j is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

In Table 9, PANKPSS test estimation results are given in trend for EG. In Panel A, break dates at trend are shown for each country. According to the findings, there are break points at trend for EG variable. Test statistics of all countries are lower than the critical values and the null hypothesis expressing stationarity cannot be rejected. EG variable is level stationary for all countries.

In Panel B, the test statistics are lower than the critical values (99%, 95% and 90%) in Panel C for all OPEC countries and the null hypothesis cannot be rejected. Findings show that the breaks affect the stationarity of the variables. Although different break dates are determined for the countries, it is seen that the breaks get more intense in 1980s and economic growth could be said to have been affected from the oil shock for OPEC countries.

Table 10: Structural Break Individualand Panel Unit Root (PANKPSS) Test Results (LOP-Constant)

Panel A: Individual KPSS Test and Break Dates										
							Finite Sample Critical Values			
Countries	**KPSS**	**m**	$T_{b,1}$	$T_{b,2}$	$T_{b,3}$	T_{b4}	0.90	0.95	0.975	0.99
Algeria	0.040	1	1990	-	-	-	0.124	0.163	0.207	0.280
Ecuador	0.043	3	1983	1990	1997	-	0.156	0.207	0.248	0.330
Gabon	0.032	2	1985	2004	-	-	0.143	0.197	0.243	0.334
Iran	0.030	3	1985	1993	2008	-	0.146	0.193	0.236	0.294
Kuwait	0.058	2	1974	1985	-	-	0.129	0.172	0.218	0.290
Nigeria	0.086	2	1985	1993	-	-	0.136	0.155	0.178	0.207
Saudi Arabia	0.046	2	1985	2003	-	-	0.131	0.173	0.221	0.293
Venezuela	0.027	3	1987	1994	2009	-	0.157	0.204	0.260	0.351

Panel B: Panel Stationarity (PANKPSS) Tests		
	Test Statistics	**Prob.**
$LM(\lambda)(hom)^a$	-1.558	0.940
$LM(\lambda)(het)^b$	-1.134	0.872

Panel C: Asymptotic and Bootstrap Critical Values								
Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
$LM(\lambda)(hom)^a$	-1.114	-0.923	-0.718	-0.466	2.395	3.022	3.602	4.364
$LM(\lambda)(het)^b$	-0.808	-0.560	-0.276	-0.006	3.742	4.652	5.493	6.682

Note: (i) KPSS is Kwiatkowski. Phillips, Schmidt and Shin tests; m: is the number of structural breaks and Tb,j is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

In Table 10, PANKPSS test stationary estimation results are given for LOP. It is seen that there are many break points at stationary for LOP variable. In Panel A in Table 10, the test statistics of all countries are lower than the critical values. Null hypothesis expressing stationarity for LOP variable cannot be rejected and LOP variable is level stationary for the OPEC countries selected in the study.

In Panel B, test statistics are lower than the critical values in Panel C (99%, 95% and 90%) and the null hypothesis of the stationarity cannot be rejected. Break dates are seen to have been intensive in 1980 and following years. In this respect, it could be said that the impacts of oil shock have also continued in the following years.

Table 11: Structural Break Individual and Panel Unit Root (PANKPSS) Test Results (LOP-Trend)

Panel A: Individual KPSS Test and Break Dates

Countries	KPSS	m	$T_{b,1}$	$T_{b,2}$	$T_{b,3}$	Finite Sample Critical Values			
						0.90	0.95	0.975	0.99
Algeria	0.034	2	1975	1999	-	0.125	0.164	0.211	0.259
Ecuador	0.021	2	1980	1999	-	0.139	0.184	0.219	0.261
Gabon	0.132	3	1981	1998	2009	0.146	0.194	0.234	0.276
Iran	0.157	3	1978	1997	2009	0.144	0.184	0.220	0.267
Kuwait	0.055	2	1975	1999	-	0.113	0.154	0.192	0.232
Nigeria	0.021	2	1980	1998	-	0.150	0.193	0.231	0.289
SaudiArabia	0.167	3	1981	1998	2009	0.145	0.187	0.226	0.273
Venezuela	0.165	3	1981	1997	2009	0.144	0.182	0.217	0.268

Panel B: Panel Stationarity (PANKPSS) Tests

	Test Statistics	Prob.
LM(λ)(hom)[a]	4.719	0.000
LM(λ)(het)[b]	24.348	0.000

Panel C: Asymptotic and Bootstrap Critical Values

Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
LM(λ) (hom)[a]	2.939	3.420	3.816	4.479	13.324	16.192	19.167	24.086
LM(λ) (het)[b]	3.504	4.091	4.913	6.000	26.809	33.127	38.643	44.999

Note: (i) KPSS is Kwiatkowski. Phillips, Schmidt and Shin tests; m: is the number of structural breaks and Tb, j is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

In Table 11, PANKPSS test is estimated with trend for LOP. In Panel A, break dates at trend are shown for each countries. KPSS test statistics of LOP variable are lower than the critical values for all countries. In this respect, the null hypothesis expressing stationarity cannot be rejected. LOP values are level stationary for Algeria, Ecuador, Gabon, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela.In Panel B, test statistics support the stationarity null hypothesis for all of the OPEC countries. When break dates are examined, it is seen that 1980, 1999 and 2009 years are the significant break dates for crude oil prices.

Table 12: Structural Break Individual and Panel Unit Root (PANKPSS) Test Results (INF-Constant)

Panel A: Individual KPSS Test and Break Dates											
								Finite Sample Critical Value			
Countries	**KPSS**	**m**	$T_{b,1}$	$T_{b,2}$	$T_{b,3}$	$T_{b,4}$	$T_{b,5}$	0.90	0.95	0.975	0.99
Algeria	0.108	2	1984	1993	-	-	-	0.119	0.167	0.228	0.314
Ecuador	0.971	4	1975	1984	1991	1999	-	0.183	0.332	0.476	0.597
Gabon	0.063	4	1974	1981	1993	2007	-	0.248	0.270	0.291	0.318
Iran	0.065	5	1979	1987	1994	2001	2009	0.115	0.179	0.401	0.485
Kuwait	0.249	2	1989	2007	-	-	-	0.134	0.172	0.221	0.278
Nigeria	0.080	4	1976	1987	1994	2004-	-	0.132	0.275	0.405	0.480
SaudiArabia	0.117	3	1974	1990	2008	-	-	0.138	0.178	0.225	0.294
Venezuela	0.072	3	1988	1995	2009	-	-	0.163	0.210	0.269	0.375

Panel B: Panel Stationarity (PANKPSS) Tests		
	Test Statistics	**Prob.**
LM(λ) (hom)[a]	4.322	0.000
LM(λ) (het)[b]	18.640	0.000

Panel C: Asymptotic and Bootstrap Critical Values								
Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
LM(λ)(hom)[a]	1.577	1.946	2.241	2.551	6.368	7.363	8.497	10.059
LM(λ)(het)[b]	2.250	2.700	3.122	3.605	10.112	11.742	13.115	15.001

Note: (i) KPSS is Kwiatkowski. Phillips, Schmidt and Shin tests; m: is the number of structural breaks and Tb,j is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

In Table 12, PANKPSS test is estimated at constant for INF. There are many break points at stationary for INF variable. In Panel A, test statistics of all countries are lower than the critical values. Null hypothesis expressing the stationarity cannot be rejected. INF variable is level stationary for all countries.In Panel B, test statistics are lower than the critical values in Panel C (99%, 95% and 90%) and the null hypothesis of the stationarity cannot be rejected. Break dates start from 1974s and also contain the global economic crisis periods until 2009.

In Table 13, PANKPSS test estimation results are given in trend for INF. In Panel A, break dates at trend are shown for each country. Test statistics of all countries are lower than the critical values and the null hypothesis expressing stationarity cannot be rejected. In this respect, INF variable is level stationary for all countries. In Panel B, the test statistics are lower than the critical values (99%, 95% and 90%) in Panel C for all OPEC countries and the null hypothesis cannot be rejected. According to the test results in Table

13, break points show differences and the most number of breaks occurred in 1974. And, this shows that the inflation variable was affected from 1974 oil shock for the mentioned countries.Structural break dates have been determined in EG, LOP and INF variables. Break points in the series to be found significant causes to the attainment of the results within the direction that the stationary series are not stationary in reality. Therefore; classical unit root tests may give results showing that level stationary variables are not stationary.According to the results of unit root analysis; EG, LOP and INF variables have been determined to be stationary when their first differences have been taken. In this respect; Westerlund (2006) cointegration analysis is used for the long term relations among the variables. Westerlund Cointegration test results are given place in Table 14.

Table 13: Structural Break Individual and Panel Unit Root (PANKPSS) Test Results (INF-Trend)

Panel A: Individual KPSS Test and Break Dates									
						Finite Sample Critical Values			
Countries	**KPSS**	**m**	$T_{b,1}$	$T_{b,2}$	$T_{b,3}$	0.90	0.95	0.975	0.99
Algeria	0.360	2	1974	1993	-	0.146	0.201	0.258	0.327
Ecuador	0.025	3	1981	1988	1999	0.148	0.192	0.233	0.292
Gabon	0.030	3	1974	1985	1993	0.137	0.185	0.224	0.279
Iran	0.066	3	1974	1994	2009	0.130	0.170	0.210	0.271
Kuwait	0.048	1	1974	-	-	0.138	0.183	0.234	0.287
Nigeria	0.056	2	1986	1994	-	0.142	0.184	0.227	0.279
Saudi Arabia	0.029	2	1975	2007	-	0.130	0.182	0.220	0.255
Venezuela	0.232	3	1985	1995	2009	0.144	0.182	0.227	0.276

Panel B: Panel Stationarity (PANKPSS) Tests		
	Test Statistics	**Prob.**
$LM(\lambda)(hom)^a$	11.193	0.000
$LM(\lambda)(het)^b$	15.171	0.000

Panel C: Asymptotic and Bootstrap Critical Values								
Model	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
$LM(\lambda)(hom)^a$	-0.201	0.197	0.470	0.826	9.713	12.307	14.778	17.588
$LM(\lambda)(het)^b$	1.450	1.925	2.401	3.085	12.862	14.839	16.685	19.447

Note: (i) KPSS is Kwiatkowski. Phillips, Schmidt and Shin tests; m: is the number of structural breaks and Tb,j is the structural break date. (ii) a: Results have been attained under the assumption that cross sections are independent, b: Results take the cross section dependency into consideration. (iii) Test hypotheses: H_0: There is no unit root, H_a: There is unit root.

Table 14: Westerlund (2006) Cointegration Test Results

Model	LM Test Statistics	Asym. K.D.[a]	Decision	Bootstrap K.D.[b]	Decision
Model 1: EG=f(LOP)					
Constant	10.633	0.000	Cointegration	0.115	Cointegration
Constant+Trend	9.652	0.000	Cointegration	0.000	Cointegration
Constant+Break	2.638	0.004	Cointegration	0.108	Cointegration
Constant+Trend+Break	3.428	0.000	Cointegration	0.698	Cointegration
Model 2: EG=f(LOP, INF)					
Constant	3.601	0.000	Cointegration	0.396	Cointegration
Constant+Trend	8.224	0.000	Cointegration	0.000	Cointegration
Constant+Break	1.297	0.097	Cointegration	0.715	Cointegration
Constant+Trend+Break	18.411	0.000	Cointegration	0.573	Cointegration

Note: (i) Westerlund (2006) test gives the results of the Unit Root and Cointegration results with the same test statistics. (ii) a: There is no cross section dependency. b: there is cross section dependency. (iii) H_0: There is no cointegration. H_a: There is cointegration.

In Table 14, cointegration test results are seen for Model 1 and Model 2. Null hypothesis expressing the absence of cointegration is rejected when the test statistics are compared to two different critical values. According to the findings; there is cointegration relation between EG and LOP. It is also seen that there is cointegration relation between EG and LOP and INF. According to this, error correction model is estimated. Estimation is conducted with Augmented Mean Group (AMG) method that provides successful estimations for many problems such as cross section dependency, heterogeneity of parameters and multiple linear connections to estimate the long term relation. Estimation results are given place in Table 15-18.

Table 15: Long Term Estimation (Augmented Mean Group)

Coefficients and t statistics		
Model	**LOP**	**INF**
Model 1: EG = f(LOP)	0.04265** (2.46)	-
Model 2: EG = f(LOP, INF)	-0.3455*** (-5.78)	-0.6860*** (-5.80)
Swamy test	**χ^2 Prob.**	**Decision**
Model 1	94.86*** (0.0000)	Parameters are heterogeneous
Model 2	193.57*** (0.0000)	Parameters are heterogeneous

Note: (i) LOP: expresses the long term parameter of real crude oil price, INF: expresses the long term parameter of the inflation variable, (ii) Swamy test: has been used to determine the homogeneity of the parameters before the cointegration, causality and estimator selection, (iii) *, ** and ***respectively express 10%, 5% and 1% significance levels.

In Table 15, long term coefficient of LOP variable of Model 1 is approximately 0.043. This coefficient has been found statistically significant at 5% significance level. In this respect, it is possible to say that 1% increase occurring in long term in real crude oil prices (LOP) increases the economic growth (EG) by 0.043% unit. Real crude oil prices do not significantly affect the economic growth in long term.In Model 2, long term coefficient of LOP is approximately -0,35; long term coefficient of INF is approximately -0,69. Both coefficients are statistically significant at all significance levels. In this respect, while 1% increase occurring in long term in real crude oil prices (LOP) decreases the economic growth (EG) by -0,35% unit, 1% increase occurring in the inflation (INF) in long term decreases the economic growth (EG) by -0,69% unit. According to the findings; changes in real crude oil prices (LOP) and inflation (INF) has a decreasing impact on the economic growth (EG) in long term.

Table 16: Long Term Estimation (Augmented Mean Group)

Coefficients and t- statistics			
Model and Country			
Model 1: EG=	f(LOP)	LOP	INF
Algeria		0,0446(3.49***)	-
Ecuador		0.0048(0.77)	-
Gabon		0.0660(2.18**)	-
Iran		0.0852(3.12***)	-
Kuwait		0.0125(0.29)	-
Nigeria		0.0054(-0.26)	-
Saudi Arabia		0.1324(3.09***)	-
Venezuela		0.0009(0.09)	-
Model 2: EG=	f(LOP, INF)		
Algeria		-0.4661 (-7.65***)	-0.7529(-9.55***)
Ecuador		-0.2376 (-4.23***)	-0.2871(-4.49***)
Gabon		-0.5259(-4.57*)	-1.1850(-5.32***)
Iran		-0.1856 (-1.83***)	-0.3434(-3.19***)
Kuwait		-0.4049 (-3.54***)	-0.8664(-4.23***)
Nigeria		-0.5592 (-5.42***)	-0.7178(-6.56***)
Saudi Arabia		-0.0931 (-0.46)	-0.999(-1.55)
Venezuela		-0.2920 (-3.41***)	-0.3365(-3.50***)

Note: (i) LOP: expresses the long term parameter of real crude oil price, INF: expresses the long term parameter of the inflation variable for countries, (ii) Swamy test: has been used to determine the homogeneity of the parameters before the cointegration, causality and estimator selection, (iii) *, ** and *** respectively express 10%, 5% and 1% significance levels.

In Table 16, there are the long-term estimated parameters on the basis of the countries. In Model 1, long term parameter is statistically significant in Algeria, Iran and Saudi Arabia. The parameter has been estimated as approximately 0.05 for Algeria, 0.005 for Gabon, 0.09 for Iran and 0.13 for Saudi Arabia.

According to the findings; 1% increase in real crude oil prices (LOP) in long term causes to an increase in economic growth (EG) by 0.05% in Algeria, 0.005 in Gabon, 0.09 in Iran and 0.13 in Saudi Arabia. As in the long term parameter calculated as panel, long term parameter has also been found too low on country basis. In Model 2, long term parameters of all countries except for Saudi Arabia are statistically significant. In Algeria, 1% increase occurring in LOP in long term decreases EG by -0,47% and 1% increase occurring in INF decreases EG by -0,75%. In Ecuador, 1% increase occurring in LOP in long term decreases EG by -0,24% and 1% increase occurring in INF decreases EG by -0,29%. In Gabon, 1% increase occurring in LOP in long term decreases EG by -0,53% and 1% increase occurring in INF decreases EG by -1,18%. In Iran, 1% increase occurring in LOP in long term decreases EG by -0,19% and 1% increase occurring in INF decreases EG by -0,34%. In Kuwait, 1% increase occurring in LOP in long term decreases EG by -0,41% and 1% increase occurring in INF decreases EG by -0,87%. In Nigeria, 1% increase occurring in LOP in long term decreases EG by -0,56% and 1% increase occurring in INF decreases EG by -0,72%. In Venezuela, 1% increase occurring in LOP in long term decreases EG by -0,29% and 1% increase occurring in INF decreases EG by -0,34%.

Table 17: Long Term Estimation (Augmented Mean Group)

Coefficients and t-statistics			
Model	**EC**	**ΔLOP**	**ΔINF**
Model 1: ΔEB = f(EC, ΔLOP)	-0.3433*** (-5.77)	0.2813*** (4.23)	-
Model 2: ΔEB = f(EC, ΔLOP, ΔINF)	-0.3574*** (-5.05)	0.1919 (1.58)	0.0968 (0.33)

Note: (i) ΔLOP: expresses the short term parameter of real crude oil price, ΔINF: expresses the short term parameter of inflation for models, EC: expresses the error correction parameter for models. **(ii)** *, ** and *** respectively express 10%, 5% and 1% significance levels.

In Table 17, error correction parameter of models and the short term parameter of LOP and INF variables are given. In Model 1, error correction parameter is negative and statistically significant. According to the findings; there is a long term relation between LOP and EG. It could be said that 34% of the imbalances occurring in a period will get better after a period and it will reach its old long term balance after 3 periods. 1% increase occurring in real crude oil prices in short term increases the economic growth by 0.28% unit. In Model 2, error correction parameter is negative and significant. There is a long term relation. However; short term parameters are not significant.

Table 18: Long Term Estimation (Augmented Mean Group)

Coefficients and t Statistics			
Model and Countries	**EC**	**ΔLOP**	**ΔINF**
Model 1:ΔEG = f(EC, ΔLOP)			
Algeria	-0.2725(-4.87***)	0.0879(2.80***)	-
Ecuador	-0.4579(-4.92***)	0.0772(1.60)	-
Gabon	-0.1834(-2.64***)	0.3708(5.29***)	-
Iran	-0.6054(-5.51***)	0.0596(0.47)	-
Kuwait	-0.3142(-3.16***)	0.5022(5.92***)	-
Nigeria	-0.1409(-1.72*)	0.4257(4.63***)	-
Saudi Arabia	-0.2444(-3.97***)	0.4836(7.50***)	-
Venezuela	-0.5281(-4.98***)	0.2434(4.30***)	-
Model 2:ΔEG= f(EC, ΔLOP, ΔINF)			
Algeria	-0.3308 (-4.46***)	-0.1946 (-2.89***)	-0.5020(-6.20***)
Ecuador	-0.8201(-10.18***)	-0.3254(-5.56***)	-0.6019(-4.74***)
Gabon	-0.1593(0.94)	-0.1250(-1.07)	0.2044(0.38)
Iran	-0.5664(-5.65***)	-0.2216(-1.73*)	-0.7589(-1.42)
Kuwait	-0.5961(-5.23***)	0.1809(1.30)	-0.2539(-1.00)
Nigeria	-0.2096(-2.30**)	0.0388(0.33)	-0.4865(-1.46)
Saudi Arabia	-0.4478(-1.33)	0.0906(0.65)	-0.2768(-0.34)
Venezuela	-0.7047(-5.84***)	-0.2143(-2.53**)	-0.8323(-5.25***)

Note: (i) ΔLOP: expresses the short term parameter of real crude oil price, ΔINF: expresses the short term parameter of inflation for models EC: expresses the error correction parameter of the model for countries, (ii) *, ** and *** respectively express 10%, 5% and 1% significance levels.

In Table 18, error correction parameter and short term parameter estimations are given on the basis of countries. In Model 1, error correction parameter is negative and statistically significant for all countries. In this respect, a long term relation could be mentioned. 27% of the imbalances occurring in a period in Algeria will get better after a period and it will reach its old long term balance approximately after 3 periods. 46% of the imbalances occurring in a period in Ecuador will get better after a period and it will reach its old long term balance approximately after 2 periods. 18% of the imbalances occurring in a period in Gabon will get better after a period and it will reach its old long term balance approximately after 5 periods. 61% of the imbalances occurring in a period in Iran will get better after a period and it will reach its old long term balance approximately after 1.5

periods. 31% of the imbalances occurring in a period in Kuwait will get better after a period and it will reach its old long term balance approximately after 3 periods. 14% of the imbalances occurring in a period in Nigeria will get better after a period and it will reach its old long term balance approximately after 7 periods. 24% of the imbalances occurring in a period in Saudi Arabia will get better after a period and it will reach its old long term balance approximately after 4 periods. 53% of the imbalances occurring in a period in Venezuela will get better after a period and it will reach its old long term balance approximately after 2 periods.

According to Table 18, 1% increase occurring in real crude oil prices in short term in Algeria increases EG by 0.09% unit. 1% increase occurring in real crude oil prices in short term in Gabon increases EG by 0.37% unit. 1% increase occurring in real crude oil prices in short term in Kuwait increases EG by 0.50% unit. 1% increase occurring in real crude oil prices in short term in Nigeria increases EG by 0.43% unit. 1% increase occurring in real crude oil prices in short term in Saudi Arabia increases EG by 0.48% unit. 1% increase occurring in real crude oil prices in short term in Venezuela increases EG by 0.24% unit.

According to Model 2, error correction parameter of all countries except for Gabon and Saudi Arabia is negative and statistically significant. 33% of the imbalances occurring in a period in Algeria will get better after a period and it will reach its old long term balance approximately after 3 periods. 82% of the imbalances occurring in a period in Ecuador will get better after a period and it will reach its old long term balance approximately after 1 period. 57% of the imbalances occurring in a period in Iran will get better after a period and it will reach its old long term balance approximately after 1.5 periods. 60% of the imbalances occurring in a period in Kuwait will get better after a period and it will reach its old long term balance approximately after 1.5 periods. 21% of the imbalances occurring in a period in Nigeria will get better after a period and it will reach its old long term balance approximately after 5 periods. 70% of the imbalances occurring in a period in Venezuela will get better after a period and it will reach its old long term balance approximately after 1.5 periods. Short term parameters of Algeria, Ecuador, Iran and Venezuela are statistically significant.

In Algeria, 1% increase occurring in LOP in long term decreases EG by -0,19% and 1% increase occurring in INF decreases EG by -0,50%. In Ecuador, 1% increase occurring in LOP in long term decreases EG by -0,33% and 1% increase occurring in INF decreases EG by -0,60%. In Venezuela, 1% increase occurring in LOP in long term decreases EG by -0,21% and 1% increase occurring in INF decreases EG by -0,83%.

In Table 19, causality relation among the variables is examined with Dumitrescu and Hurlin (2012) test taking Granger causality test as the basis. According to the results; three different test statistics as W-bar, Z-bar and Z-bar tilde are attained for the causality test. In this respect; there are one-sided causality relations from real crude oil prices to economic growth, from inflation to real crude oil prices and from economic growth to inflation.

Table 19: Causality Test Results – Dumitrescu and Hurlin (2012) Test

Causality Direction	W-bar	Z-bar(p-value)	Z-bar tilde (p-value)
EG ←LOP	2.0719	2.1438(0.0321)	1.8860 (0.0593)
EG←INF	1.0811	0.1621 (0.8712)	0.0616 (0.9509)
LOP←EG	0.8909	-0.2181 (0.8273)	-0.2885(0.7730)
LOP←INF	3.1207	4.2415 (0.0000)	3.8172(0.0001)
INF←EG	3.8870	5.7740(0.0000)	5.2282 (0.0000)
INF←LOP	1.9150	1.8299(0.0673)	1.5970(0.1103)

Not: (i) H_0: Variable X is not the reason of variable Y. H_a: Variable X is the reason of variable Y.
(ii) *, ** and *** are respectively 10%, 5% and 1% significance levels.

4. Discussions and Suggestıons

In the study, relations among economic growth (EG), inflation (INF) and real crude oil prices (LOP) are examined with Dynamic Panel Data Analysis approach for the period 1968-2016 as well as the inflation impact for some countries (Algeria, Ecuador, Gabon, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela) selected as the members of the Organization of Petroleum Exporting Countries (OPEC). For this purpose, Panel Unit Root Tests, Structural Break Panel Unit Root Tests, Panel Cointegration and Causality Tests have been used. Stationarity of the variables has been examined with Carrion-i Silvestre et. al. (2005) being from the structure break unit root tests with the theoretical foresight that social and economic crises may also have impacts on the variables such as economic growth, crude oil prices and inflation being the economic indicators of the countries. Stationary and trend structural break test results show that non-stationarity of the series stems from structural breaks and although there are different break periods for the economic growth, real crude oil prices and especially inflation variables of the countries, 1973-1974 and 1979-1980 world oil shocks and 2008 financial crisis have impacts on the mentioned variables.

Long term relations of the OPEC countries among economic growth, inflation and real crude oil prices have been examined with Westerlund Cointegration Test (2006). Estimation results show that the increase in the inflation and oil prices have a negative impact on the economic growths of the countries. Also, the findings of the study show a contrary to Akide (2007) study for Nigeria.

According to the results of the estimated Panel Error Correction Model; there is a long term balance relation among the inflation, growth and real oil prices of the countries. Short term parameters are statistically significant for Algeria, Ecuador, Iran and Venezuela. The increase generally in the crude oil prices and inflation in short term has a negative impact on the economic growths of the countries. The increase in crude oil prices for Ecuador is positively efficient in long term on the economic growth.

Panel causality results show one-sided causality relations for the examined OPEC countries from economic growth to inflation, from inflation to oil prices and from oil prices to economic growth. The results support Gua and Kliesen (2005) and Omojolaibi and Egwaikhide (2013).

It is possible to say that this situation occurs due to the fact that the demand increasing for the goods and services together with the economic growth process in the countries increases the oil prices together with the inflationist impact. Oil exporting countries try to protect their own national economies against the malicious impacts of the inflation by reflecting the increasing costs in the production of industrial products to the prices of the products depending on the oil price increase. As a result of the oil price increase; especially the developing countries have to spare an extra share for also the industrial products because of the fact that they use the oil products in their transportation, industry and service sectors as inputs in addition to the additional import sum they will pay for the crude oil. This cost increase based on external factors in production causes the inflation to proceed to a rising trend in the mentioned developing countries. Therefore; any valuation possible to occur in the exchange rates of the importer countries due to the increase in oil prices negatively affects the dependent oil exporter countries. It is necessary for the countries with high dependency on oil to focus on energy resources alternative to oil and decrease the level of dependency on oil to prevent the changes in oil prices to cause to significant changes in their productions and therefore, their real incomes. Long term decreases in oil prices may cause to long term decreases in the oil export incomes of OPEC countries and may force the OPEC countries to conduct hard economic, social and political changes.

5. Conclusions and Policy Implications

Oil as one of the most important energy resources and energy inputs has significant impacts directly or indirectly on the macroeconomic variables of the countries. In this respect, it has a very important function in whether the economic growths of the countries are sustainable or not. Oil price volatilities have active role in economy policies especially for the oil importing /oil expoting countries. Hardships are seen in the implementation of the monetary and financial policies of the countries due to the fluctuations in oil prices. Oil shocks are also active in the instability of the state economies. For this reason, the examination of the causality relations between oil prices and economic growth has significance also for the policy makers in terms of the financial planning.

In this study, the relations among economic growth, inflation and worldwide crude oil prices are examined with Dynamic Panel Data Approach. For this purpose; the relationships of the selected 8 countries (Algeria, Ecuador, Gabon, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela) being the members of the Organization of the Petroleum Exporting Countries (OPEC) in terms of economic growth, inflation and real oil prices are assessed. According to the findings; OPEC countries show cross section dependency in terms of the economic growth (EG) and real crude oil prices (LOP). There is a long-term relationships among the variables of economic growth (EG), inflation (INF) and real crude oil prices (LOP), according to the results of Cointegration test. Except for Saudi Arabia, changes in real crude oil prices and inflation for OPEC countries have a negative impact on economic growth in the long run. The 1% unit increase in oil prices has the greatest negative impact on economic growth, respectively, in Nigeria (0.56%), Gabon (0.53%) and Algeria (0.47%). Similarly, 1% unit increase in inflation has the highest negative impact on economic growth in Kuwait (0.87%), Algeria (0.75%) and Nigeria (0.72%), respectively. Furthermore, panel causality test results support the one-sided causality relationships from real crude oil prices to economic growth, from inflation to real crude oil prices and from economic growth to inflation. According to the findings of the study; it is possible to say that OPEC countries, which are open to inflationary structures due to the growth dynamics, do not manage their sustainable growth processes well. It can also be concluded that OPEC countries cannot make optimal decisions on oil prices and have not achieved much success in implementing effective policies.

References

Aarón, G. and Nabiyev, S., 2009, Oil price fluctuations and its effect on GDP growth: A case study of USA and Sweden, Jonkoping International Business School, Jonnkoping University, Unpublished PhD Thesis.

Adam, A.M. and Tweneboah, G., 2008, Implications of oil price shocks for monetary policy in Ghana: A Vector Error Correction Model, http://ssrn.com/abstract=1312366 (Access Date: 10.01.2018).

Akıncı, M., Aktürk E. and Yılmaz Ö., 2013, Petrol Fiyatları ile Ekonomik Büyüme Arasındaki İlişki: Opec ve Petrol İthalatçısı Ülkeler İçin Zaman Serisi Analizi , Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 17(1), 349-361.

Akide, A., 2007, Growth implications of oil price variations: A case study of Nigeria, Researces Policy, 8(2), 20-27.

Akinlo, T. and Apanisile, O.T., 2015, The Impact of volatility of oil price on the economic growth in Sub-Saharan Africa, British Journal of Economics, Management Trade, 5(3), 338-349.

Alagöz, M., Alacahan, N.D, and Akarsu, Y., 2017, Petrol Fiyatlarının Makro Ekonomi Üzerindeki Etkisi-Ülke Karşılaştırmaları İle Panel Veri Analizi, KMÜ Sosyal and Ekonomik Araştırmalar Dergisi, 19 (33), 144-150.

Bai, J. and Perron, P., 1998, Estimating and Testing Linear Models with Multiple Structural Changes, Econometrica, 66, 47–78.

Bai, J. and Perron, P., 2003, Computation and Analysis of Multiple Structural Change Models, Journal of Applied Econometrics, 18, 1–22.

Baltagi, B.H., 2008, Econometric Analysis of Panel Data, Fourth Edition, West Sussex: John Wiley & Sons.

Bayraç, H. N., 2005, Uluslararası petrol piyasasınınekonomikanalizi, Finans-Politik and Ekonomik Yorumlar, 499, 6-20.

Bernanke, Ben S., 1983, Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression, American Economic Review, 73, 257-76.

Breusch, T., and Pagan, A., 1980, The lagrange multiplier test and its applications to model specification in econometrics, The Review of Economic Studies, 47(1), 239-253.

Brini, R., Jemmali, H. and Farroukh, A., 2016, Macroeconomic impacts of oil price shocks on inflation and real exchange rate: Evidence from selected MENA countries, Topics in Middle Eastern and African Economies, 18(2), 170-184.

Burbidge, J. and Harrison, A., 1984, Testing for the Effects of Oil-Price Rises Using Vector Autoregressions, International Economic Review,. 25(2), 459-484.

Carrion-i-Silvestre, J., Del Barrio-Castro, T., and Lopez-Bazo, E., 2005, Breaking the panels: an application to the GDP per capita, Econometrics Journal, 159-175.

Choi, I., 2001, .Unit RootTestsfor Panel Data, Journal of International Money and Finance. 20, 249-272.

Cunado J. and de Gracia F., 2003,. Do Oil Shocks Matter? Evidence for some European Countries, Energy Economics, 25, 137–15.

Darby M., 1982, The Price of oil and World inflation and Recession, American Economic Review, 72 (4), 738-751.

Demir, İ., 2008, OPEC: Güçlü BirKartel, SDU Fen Edebiyat Fakültesi Sosyal Bilimler Dergisi, 18, 231-246.

Dogrul H.G., Soytas U., 2010, Relationship between oilprices, interestrate, and unemployment: evidence from an emerging market, Energy Economics, 32, 1523–8.

Dumitrescu, E. and Hurlin, C., 2012, Testing for Granger non-causality in heterogeneous panels, Economic Modelling, 1450-1460.

Ferderer, J. P., 1996, Oil Price Volatility and the Macroeconomy, Journal of Macroeconomics, 18(1), 1-26.

Forgha, N.G., Sama, M.C., and Achuo, E.D., 2015, Petroleum Products Price Fluctuations and Economic Growth in Cameroon, Growth, 2(2), 30-40.

Glasure, Y.U. and Lee, A.R., 1997, Cointegration, Error Correction and Energy: The Case of South Korea and Singapure, Energy Economics, 20, 17-25.

Gisser, M. and Goodwin, T., 1986, Crude Oil and the Macroeconomy: Tests of Some Popular Notions, Journal of Money, Credit, and Banking, 18, 95-103.

Gonzales, A. and Nabiyev, S., 2009, Oil price fluctuations and its effect on GDP growth: A case study of USA and Sweden, Bachelor Thesis within economics, Jönköping International Business School.

Gómez-Loscos, A., Gadea, M.D., and Montañés, A., 2012, Economic growth, inflation and oil shocks: are the 1970s coming back? Applied Economics, 44, 4575–4589.

Gökçe, C., 2014, Önemli Bir Enerji Girdisi Olan Petrolün Ekonomik Kalkınma Sürecindeki Rolü, AKÜ İİBF Dergisi, XVI(1), 143-153.

Gua, H. andKliesen, K.L., 2005, Oil price volatility and U.S. macroeconomic activity, Federal Reserve Bank of St. Louis Review, 87(6), 669-83.

Guloglu, B. andİvrendi, M., 2008, Output fluctuations: transitory or permanent? The case of Latin America, Applied Economic Letters, 17 (4), 381-386.

Guloglu, B. and İvrendi, M., 2010, Output fluctuations: transitory or permanent? The case of Latin America, Applied Economics Letters, 17(4), 381-386.

Hadri, K., 2000, Testing for Unit Roots in Heterogeneous Panel Data, Econometrics Journal, 3, 148-161.

Hamilton, J.D., 1983, Oil and the macro economy since World War II, Journal of political economy, 91(2), 593-617.

Hamilton, J. D., 1996, This is what happened to the oil price-macroeconomy relationship, Journal of Monetary Economics, 38(2), 215-220.

Hamilton J. D., 2003, What is an oil shock? Journal of Econometrics, 113(2), 363-398.

Hamilton, J.D., 2009, Causes and consequences of the oil shock of 2007-08 (No: w15002), National Bureau of Economic Research.

Im, K.S., Pesaran, M.H., and Shin, Y., 1997, Testing for Unit Roots in Heterogenous Panels, DAE, Working Paper 9526, University of Cambridge.

Im, K., Pesaran, H. And Shin, Y., 2003, Testing For Unit Roots in Heterogenous Panels, Journal of Econometrics, 115, 53–74.

Jawad, M., 2013, Oil price volatility and its impact on economic growth in Pakistan, Journal of Finance and Economics, 1(4), 62-68.

Jo, S., 2012, The effects of oil price uncertainty on the macroeconomy, Bank of Canada Working Paper, 40, 1-42.

Kao, C., 1999, Spurious Regression and Residual – Based Tests for Cointegration in Panel Data, Journal of Econometrics, 90, 1-44.

Katircioglu S.T, Sertoglu K., Candemir M. and Mercan M., 2015, Oil price movements and macroeconomic performance: evidence from twenty-six OECD countries, Renewable and Sustainable Energy Reviews, 44, 257–270.

Lee, K., Shawn N.and Ronald A. R., 1995, Oil Shocks and TheMacroeconomy: The Role of Price Variability, The Energy Journal, 39-56.

Levin, A., Lin, C.F., and Chu., C.S.J., 2002, UnitRoot Test in Panel Data: Asymptotic and Finite Sample Properties, Journal of Econometrics, 108, 1-24.

Lopez, L. and Weber, S., 2017, Testing for Granger causality in Panel Data, University of Neuchatel Institute of Economic Research, IRENE Working Paper, 17-03.

Lorusso, M. and Pieroni, L., 2015, Causes and consequences of oil price shocks on the UK economy, Center for Energy Economics Research and Policy, CEERP Working Paper, 2, 1-31.

Maddala, G.S. and Wu, S., 1999, A ComparativeStudy of UnitRootTestswith Panel Data and a New Simple Test, Oxford Bulletin of Economicsa nd Statistics, Special İssue, 631-652.

Menyah, K., Nazlıoğlu, Ş. and Wolde-Rufael, Y., 2014, Financial Development, Trade Openness and Economic Growth in African Countries: New Insights from a Panel Causality Approach, Economic Modelling, 37, 386-394.

O'Connell, P., 1998, The Overvaluation of Purchasing Power Parity, Journal of International Economics, 44, 1–19.

Omojolaibi, J.A. and Egwaikhide, F.O., 2013, A Panel analysis of oil price dynamics, fiscal stance and macroeconomic effects: The case of some selected African countries, Central Bank of Nigeria Economic and Financial Review, 51(1), 61-91.

ORSAM, 2014, Ortadoğu Stratejik Araştırmalar Merkezi, Yıllık Rapor, http://orsam.org.tr/tr/petrol-fiyatlarindaki-dusus-and-ortadogu-ekonomilerine-etkileri/.

Pedroni, P., 1999, Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors, Oxford Bulletin of Economics and statistics, 61(1), 653-670.

Pesaran, M., 2004, General diagnostic tests for cross section dependence in panels, Institute for the Study of Labor (IZA), 1-42.

Pesaran, M., 2007, A simple panel unit root test in the presence of cross section dependence, Journal of Applied Econometrics, 22(2), 265-312.

Pesaran, M., Ullah, A., and Yamaga, T., 2008, A bias-adjusted LM test of error cross-section independence, The Econometrics Journal, 105-127.

Qianqian, Z., 2011, The impact of international oil price fluctuation on China's economy, Energy Procedia, 5, 1360–1364.

Rasche R., Tatom J., 1977, The effects of the new energy regime on economic capacity, production, and prices, Review, Federal Reserve Bankof St. Louis, Issue May, 2-12.

Rasche R., Tatom J., 1981, Energy price shocks, aggregate supply and monetary policy: the theory and the international evidence, Carnegie-Rochester Conference Series on Public Policy, 14 (1), 9-93.

Roeger, W., 2005, International oil price changes: impact of oil prices on growth and inflation in the EU/OECD, International Economics and Economic Policy, 2, 15-32.

Santini D., 1985, The Energy-Squeeze Model: Energy Price Dynamics in U.S. Business Cycles, International Journal of Energy Systems, 5, 18-25.

Sauter, R. and Awerbuch, S., 2003, Oil price volatility and economic activity: A survey and literature review, IEA Research Paper, 1-18.

Syzdykova, A., 2018, Petrol Fiyatlarının BRIC Ülkelerinin Borsalarına Etkisi, Uluslararası Ekonomi, İşletmeand Politika Dergisi International, 2(1), 1-20.

Westerlund, J., 2006, Testing for panel cointegration with multiple structural breaks, Oxford Bulletin of Economics and Statistics, 101-132.

Westerlund, J. and Edgerton, D.L., 2007, A panel bootstrap cointegration test,. Economics Letters,. 97, 185–190.

Yetkiner, H.İ. and Berk, İ., 2008, Petrol fiyatlarındakiartısınnedenleriandetkileri, Enerji, 01, 12-14.