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Original Research

The Impact of Oil Price Shocks on the Macroeconomic Variables of Major Oil Exporting Countries: A GVAR Approach

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Abstract

In a world scale economy considering interlinkage and interactions between countries, economic shocks will affect various economies through channels. Meantime, the oil price is one of the most important channels. New studies show that the connection between the oil price and the world economy has numerous complications which could not be incorporated in traditional frames with only taking into consideration separated and identified oil supply and demand shocks without considering synchronicity and the source of the main shocks. Therefore it is essential to model a multi-dimensional system. The purpose of this study is to investigate the impact of oil price shocks on the major macroeconomic variables of oil-exporting countries from 1974Q1 to 2019Q4 using the global vector autoregressive (GVAR) approach. The macroeconomic variables include four domestic variables, three foreign variables and one global variable. In particular, it provides a theoretical framework for the global oil market to illustrate how multi-country approach to modeling oil markets can be used to identify country-specific oil price shocks. On the empirical side, it shows the global economic implications of oil price shocks vary considerably depending on which country is subject to the shock. The results of this study indicate that the economic consequences of a positive oil price shock are different on macroeconomic variables in oil-exporting countries in short-run and long-run. However, in response to a positive oil price shock, most of OPEC countries experience long-run inflationary pressures.

Keywords: Oil Price Shock, Oil-Exporting Countries, global Economy, Macroeconomic Variables, GVAR.

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Introduction

Global financial crises over the past decades have drawn considerable attention to the global economy in which individual economies are interlinked through different channels. Financial crises in Southeast Asia, Argentina, Brazil, and Mexico were among the largest financial crises in the 1980s and 1990s, leading to the spread of the crisis to many countries. The performance of the U.S. economy in the housing and financial markets, as well as its impact on the global economy, especially in 2007 and 2008, exposed the global economy to a great recession. Regardless of the causes of economic crises, the transmission of crises is spreading through international markets and foreign trade to the economic sectors of various countries. Different countries have been affected in different ways from various economic and financial crises due to their interactions and linkages in the global economy. What is certain is that the extent of the globalization of the economy and consequently the close relationship between the global monetary and financial markets transmit the effects of the crisis of one country's economy to the economies of other countries and international markets. These transmission channels include scarce resources such as oil and gas, political and technological development, capital and labor movement across countries, cross-border trades in goods and services. Oil is one of the important sources of revenue for the oil-exporting countries as well as the main raw material in the production process in the oil-importing countries. Oil price is determined in the global markets and its fluctuations can cause instability in exporting and importing countries' macroeconomic variables. For example, in many oil-exporting countries, such as Iran, because of the government's reliance on oil revenues, changes in oil price have a significant impact on the economy, that result in inflationary pressures, exchange rates increase, economic recessions and unemployment increase in society (Hajebi et al. 2019). Studies show that these changes also affect oil-importing countries that lead to slower economic growth and higher inflation.

Studies in recent years show that the relationship between oil prices and the global economy has more complications, so that it cannot be analyzed through common econometric approaches by decomposition and identification of oil supply and oil demand shocks regardless the synchronization and the original source of shocks. Therefore, it is necessary to model a multi-dimensional system which is dealing with the curse of dimensionality (i.e. the proliferation of parameters as the dimension of the model grows) Pesaran et al. (2004). In addition, the outbreak of wars and unexpected events such as sanctions have significant effects on oil supply and oil demand. Thus, it is essential to provide appropriate solutions at the level of global and cross-country interdependencies to reduce or prevent economic vulnerability and to avoid the recurrence of the effects of crises regarding previous business cycles. Although a few large global models existed, such models tend to be difficult to use for simulation analysis and they are often incomplete. The Global VAR (GVAR) framework was developed by Pesaran et al. (2004) to fill this gap in global modeling and simulation analysis. Numerous studies have investigated the effects of these shocks in different countries; no study has been conducted by the global vector auto regression (GVAR) in Iran. In recent years, the main focus of much research has been on oil-importing countries, which are mostly developed and less attention has been paid on other countries. Even in studies in which exporting countries were studied, the method was

not dynamic and the number of countries was limited. The purpose of this study was to investigate the impact of oil price shocks on the major oil exporting countries that cover more than 90% of world production and have 80% of world oil reserves. Therefore, it is worthy to use a method for simultaneously examining oil price shocks in a dynamic context in a global economy and consequently adopting appropriate policies to maintain liquidity stability and changes in asset composition.

Literature review

Despite extensive studies on the impact of oil price shocks on the macroeconomic variables of countries, their analysis is isolated from the world economy. These studies usually use VAR[1], SVAR [2]and Panel VAR approaches, which they do not account for economic interdependencies that exist among different countries. Therefore, policy decisions on the impact of oil price shocks as one of the factors affecting the economies of countries are not valid. However, in recent years in some studies in which the interactions among countries have been examined by the GVAR, the impact of oil price shocks on the economies have been investigated among which the most important of them will be presented as follows.

Galesi and Lombardi (2009) examined the impact of oil and food price shocks on 33 countries during 1999-2007 using GVAR approach. They conclude that the direct inflationary effects of oil price shocks affect mostly developed countries and food price increase significantly affects inflation of emerging countries. Baumeister and Peersman (2013) showed the dynamic effects of oil price shocks for some industrialized countries from 1986 to 2008. They found that oil-demand driven shocks resulting from global economic activity lead to higher inflation and activity in the target countries, which is consistent with the results of the Kalian's study. Greenwood et al. (2012) examined the international relationship between the economy in Korea and the role of oil price shocks. Using the GVAR for 33 countries from 1980 to 2007, they showed that the relationship is different between Korea's real economy and oil prices and its nominal economy and oil prices, so that real variables generally show a stronger response to the oil price shocks. Allegret et al. (2014) investigated the impact of oil price shocks on global imbalance and the transmission channels of these shocks. Considering 30 oil exporting and importing countries from 1980 to 2011 and using the GVAR modeling, they examined the financial and business relationship among these countries. The results showed that the oil price shocks caused by the demand side had weak impact on the global imbalance. Cashin et al. (2014) analyzed 38 countries/regions over the period of 1979–2011 through the estimation of a global VAR model. The results showed that oil supply price shocks had different economic effects compared to oil demand shocks and these effects were also different given that the target country is an importer or exporter of oil. Mohaddes and Raissi (2018) examined the global macroeconomic consequences of falling oil prices due to the oil revolution in the USA using a GVAR model for 38 countries/regions over the period 1979Q2 to 2011Q2. The results, indicated that different countries showed different responses to price shocks on U.S. oil supply, so that real GDP growth increases in both advanced and emerging market oil-

[1] Vector Auto Regressive
[2] Structural Vector Auto Regressive

importing economies. In another study, Mohaddes and Pesaran (2015) examined the impact of oil supply side shocks on 27 countries/regions from 1979Q2 to 2013Q2. Using the GVAR approach, they conclude that the macroeconomic results of supply-driven oil price shocks related significantly on the studied country. They found that oil supply shocks of Saudi Arabia had significant adverse effect for the global economy with real GDP falling in both advanced and emerging economies. Iacoviello (2018) studied the effect of oil price shocks on consumption of oil-importing countries using panel VAR for 50 countries over the years 1975-2015. The results showed that oil price declines had large and positive effects on the consumption of oil-importing countries, while it made a depression on consumption of oil exporters.

Theoretical Foundations

In the economic literature, any deviation of the variable values from their long-run expected trend is called a shock (Esfahani et al., 2014). A typical oil price shock is an increase in oil prices, which affects macroeconomic performance through real income, production cost and uncertainty (Kilian and Murphy, 2014). Many studies found that oil-price increases are expected to slow economic growth and increase inflation in oil-importing countries. As a result, rising oil prices will lead to scarcity of oil supply as a raw material for the production of firms and consequently will decrease the profits of the manufacturing firms and in the long run lead to a decrease in the production capacity of firms in those countries (Hamilton, 2013). In contrast, in oil-exporting countries, rising oil revenues are expected to have a positive impact on the economic growth of these countries, but studies show that countries that are rich in natural resources have lower economic growth than other countries; as, oil shocks can affect the total demand of the economy through the government budget (Jahadi and Elmi, 2011). In most of the major oil-exporting countries, imports will also increase, that cause damage to domestic production and double down on economic growth. But in some other oil-exporters such as Norway, oil export revenues are spent on overseas investment and an appropriate management is in place. In addition, there are some invisible factors. Therefore, the system of the global economy is a system with a large number of dimensions and its own complexities, which faces a major challenge as a result of global economic modeling. In this regard, the present paper aimed to investigate the effects of oil price shocks on macroeconomic variables of major oil exporting and importing countries using GVAR approach and it was shown how important macroeconomic variables of different countries respond to oil price shock.

Methodology of Research

The Global VAR (GVAR) approach, firstly presented in Pesaran et al. (2004) as an effective way of modeling interactions in a complex high-dimensional system such as the global economy. The most important advantage of these models is the global interdependence of countries (Buriel and Galesi, 2018). These dependencies are examined through three channels: 1) the contemporaneous interdependence of domestic variables with foreign variables and with their lagged values, 2) the dependence of domestic variables on global variables such as oil price and their related lagged values, and 3) the contemporaneous dependence of shocks of one country on shocks in another country (Dees et al., 2007).

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The GVAR approach has two-step procedure (Chudik and Pesaran, 2014). In the first step, each country (i) modeled individually as a augmented VAR model, denoted as VARX*(pi, qi), in which domestic variables are related to foreign and global variables.

$$\Phi_i(L,p_i)x_{it} = a_{i0} + a_{i1}t + \Lambda_i(L,q_i)x_{it}^* + \Psi_i(L,q_i)d_t + u_{it} \quad (1)$$

For i=0,1,…, N and t=1,…, T, the set of domestic variables for each country is represented by x_{it} and $\Phi_i(L,p_i) = I - \sum_{i=1}^{p_i}\Phi_i L^i$ indicates the matrix of related correlation coefficients. a_{i0} and a_{i1} are vector of fixed intercepts and vector f coefficients of time trend, respectively. x_{it}* is the set of foreign variables and $\Lambda_i(L,q_i) = \sum_{i=0}^{q_i}\Lambda_i L^i$ is their correlation coefficient matrix. These variables examine the effect of economy of other countries under study on a given economy through the weighted average of trade relations.

d_t is the set of global variables and $\Psi_i(L,q_i) = \sum_{i=0}^{q_i}\Psi_i L^i$is their correlation coefficient matrix. u_{it} is a vector that shows the shocks for each country. These shocks are defined as follows:

E (u_{it} ú$_{jt'}$) ={ Σ_{ij} for t=t´ and 0 for t ≠ t´}

Consequently, the relationship between domestic and foreign variables and global variables can be investigated simultaneously by GVAR modeling, and the simultaneous relationship between countries' shocks can be indicated by covariance. VARX model of each country can be estimated and put together to form the GVAR model (Smith and Galesi, 2014).

$$x_{it} = a_{i0} + a_{i1}t + \Phi_{i1}x_{i,t-1} + \Phi_{i2}x_{i,t-2} + \Lambda_{i0}x_{it}^* + \Lambda_{i1}x_{i,t-1}^* + \Lambda_{i2}x_{i,t-2}^* + u_{it} \quad (2)$$

If for each country the domestic and foreign variables are as follows:

$$z_{it} = \begin{pmatrix} x_{it} \\ x_{it}^* \end{pmatrix}$$

Then, the VARX model of each country is as follows:

$$A_i z_{it} = a_{i0} + a_{i1}t + B_{i1}z_{i,t-1} + B_{i2}z_{i,t-2} + u_{it} \quad (3)$$

$$A_i = (I_{ki}, -\Lambda_{i0}), B_{i1} = (\Phi_{i1}, \Lambda_{i1}), \qquad B_{i2} = (\Phi_{i2}, \Lambda_{i2})$$

In addition, if the domestic variables are considered as a general vector as follows:

$$x_t = \begin{pmatrix} x_{0t} \\ \vdots \\ x_{Nt} \end{pmatrix}$$

The following relation can be obtained as follows:

$$z_{it} = W_i x_t \ , \ \forall_i = 0,1, \dots, N \ (4)$$

So that, W_i is a matrix that represents trade weights and allows the model of each country to be expressed based on x_t, so that the economies under study are linked in the GVAR model. By inserting the above relation in the VARX of each country we can write:

$$A_i W_i z_{it} = a_{i0} + a_{i1} t + B_{i1} W_i z_{i,t-1} + B_{i2} W_i z_{i,t-2} + u_{it} (5)$$

The GVAR model is obtained for all endogenous variables by considering the model of each country in the relation:

$$G x_t = a_0 + a_1 t + H_1 x_{t-1} + H_2 x_{t-2} + u_t \ (6)$$

So that:

$$G = \begin{pmatrix} A_0 W_0 \\ \vdots \\ A_N W_N \end{pmatrix}, H_1 = \begin{pmatrix} B_{01} W_0 \\ \vdots \\ B_{N1} W_N \end{pmatrix}, H_2 = \begin{pmatrix} B_{02} W_0 \\ \vdots \\ B_{N2} W_N \end{pmatrix}$$

$$a_0 = \begin{pmatrix} a_{00} \\ \vdots \\ a_{N0} \end{pmatrix}, a_1 = \begin{pmatrix} a_{01} \\ \vdots \\ a_{N1} \end{pmatrix}, \quad u_t = \begin{pmatrix} u_{0t} \\ \vdots \\ u_{Nt} \end{pmatrix}$$

Matrix G is a matrix with k*k dimensions. The reduced form of the GVAR model by inverting this matrix is as follows:

$$x_t = b_0 + b_i t + F_1 x_{t-1} + F_2 x_{t-2} + v_t \ (7)$$

So that:

$$F_1 = G^{-1} H_1, F_2 = G^{-1} H_2,$$

$$b_0 = G^{-1} a_0, b_1 = G^{-1} a_1, v_t = G^{-1} u_t$$

Generalized impulse response functions (GIRFs) are used to investigate the dynamic properties of the GVAR model and to evaluate the shocks effects of a variable on different countries. These functions were first introduced by Kooper and Pesaran (1996) and then developed by Pesaran and Shin (1998) in vector error correction models. The advantage of using these functions is that they do not need to order variables and countries in GVAR models, which is an important advantage over other functions such as orthogonalized impulse response (OIR) function. GIRF functions also provide information on the dynamics of shock transmission (Di Mauro and Pesaran, 2013).

Exogeneity test of foreign and global variables

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The main assumption for estimating the GVAR model is the weak exogeneity of foreign and global variables. After estimating the VARX* model of each country, it is necessary to examine the hypothesis of weak exogeneity test of foreign and global variables. To achieve this goal, the following regression is evaluated by Johansen method (1992) and Harbo et al. (1998):

$$\Delta x^{*}_{it,l} = \mu_{il} + \sum_{j=1}^{r_i} \gamma_{ij,l} ECM^{j}_{i,t-1} + \sum_{k=1}^{p_i} \phi_{ik,l} \Delta x_{i,t-k} + \sum_{m=1}^{q_i} \theta_{im,l} \Delta x^{*}_{i,t-m} + \varepsilon_{it,l}$$

In which $ECM^{j}_{i,t-1}$ are the estimated error correction runs corresponding to the r_i represents the number of covariance relationships. The formal test for weak exogeneity is an F-test of the joint hypothesis that $\gamma_{ij,l} = 0$ for each j=0,…,r_i. If the endogenous variable is considered as exogenous, it leads to bias in the estimates. Therefore, it is necessary to ensure both efficiency and adaptability by choosing the right endogenous and exogenous variables. It is expected that the intervals of the domestic variables are longer than the foreign and global variables. The maximum lag order is determined by the Akaike and Schwarz criterion.

Sample of Countries

The countries under study in this research are divided into two groups by taking into account their highest rank in oil exports and imports and the availability of reliable data[1].

Variables and Data

In the model for each country, specific variables including real GDP (y_{it}), inflation (p_{it}), real exchange rate (ep_{it}) and real interest rate (r_{it}) are as follows:

y_{it}= ln (GDP_{it} / CPI_{it}) p_{it}= ln (CPI_{it})

ep_{it}= ln (E_{it}) – ln(CPI_{it}) $\pi_{i,t}=p_{i,t} - p_{i,t-1}$

r_{it}= 0.25 *ln(1+R_{it}/100)

Where GDP_{it} denotes nominal GDP, CPI_{it} is Consumer Price Index[2], E_{it} is U.S. nominal exchange rate, r_{it} is real interest rate and $\pi_{i,t}$ is inflation. Foreign variables which represent the influence of the rest of the world on a country, being calculated as

[1] - Major oil exporting countries: Angola, Ecuador, Algeria, Iran, Iraq, United Kingdom, Indonesia, United Arab Emirates, Bahrain, Russia, Canada, Kuwait, Saudi Arabia, Oman, Qatar, Libya, Mexico, Norway, Nigeria, Venezuela.
- Major oil importing countries: Austria, Argentina, Spain, Australia, Germany, U.S., Italy, Brazil, Turkey, China, Japan, Singapore, Switzerland, France, South Korea, Netherlands, India, Malaysia, Morocco, Egypt.

[2] In studies conducted on comparing inflation rates across countries, the Consumer Price Index is considered as an inflation proxy. www.ilo.org/uses of consumer price indices.

weighted averages of the corresponding variables of other countries, with weights based on bilateral trade flows.(Except the exchange rate for the U.S. model).

$$x_{it}^{*} = \sum_{j=1}^{N} w_{ij} x_{jt}$$

$$\text{Cov}\left[\left(\sum_{j=1}^{N} W_{ij} x_{it}\right), \varepsilon_{it}\right] \rightarrow 0$$

Domestic variables serve as endogenous and the foreign variables serve as weak exogenous and these variables are considered logarithmic[1].The global variable which is common to each country VARX model is the price of oil which is included as weak exogenous variable.

This study employs quarterly data of 40 countries for the period spanning from 1974 to 2019. The monthly dataset is collected from International Financial Statistics (IFS), World Bank Database and International Energy Agency (IEA).

Model Estimation

Unit root test and long run relations

The core variables need to be tested for stationary. For this purpose the Augmented Dickey-Fuller (ADF) unit root test and Weighted-Symmetric Dickey Fuller (WSDF) were used and the results showed that all domestic, foreign and global variables are integrated of order one (I (1)).[2].

Testing Model Stability

The GVAR model should be stable in the sense that if it is out of balance, the relation between the variables does not eliminate and the system returns to its original state over time, following Lee and Pesaran (1993) method the model is stable (Cuaresma et al., 2018).

Testing Model Dynamics

To analyze the dynamics of the GVAR model, generalized impulse response functions (GIRFs) are used following Pesaran et al. (2004). In the GVAR model generalized errors are used instead of orthogonal errors[3].

[1] Foreign variables are constructed based on the weighted average of endogenous variables of other countries, which these weights (W_{ij}) are the matrices of K*K. Pesaran et al. (2002) showed that when the sample N tends to infinity, it can be shown based on a series of assumptions that $Cov\left[\left(\sum_{j=1}^{N} \mathbf{W}_{ij}\mathbf{x}_{it}\right), \varepsilon_{it}\right] \rightarrow 0$, in other words foreign variables are weakly exogenous.

[2] Tables related to unit root test and long run relation were not included for brevity.

[3] In Cholesky decomposition the order of variables is important, whereas in GVAR models there is a large number of variables and there are many different states that are impossible to choose between. Therefore, the Cholesky method will not work.

Testing Weak Exogeneity

GVAR models are estimated by assuming the weak exogeneity of foreign and global variables. If the endogenous variable is considered as exogenous, it results in bias in the estimates, and vice versa, if the exogenous variable is assumed to be endogenous, it results in a loss of model efficiency. Therefore, it is necessary to ensure that both efficiency and compatibility be provided by choosing the right endogenous and exogenous variables (Najafi, 2016). F test is used for weak exogenous test. In this part, first, the models for each country are estimated. Rank of co-integration is identified by the assumption that foreign variables for each country are exogenously weak (I (1)). Order of models for each country is selected based on the Akaike information criterion with p_{max} and q_{max} less than 2. Table (1) summarizes the lag orders and the number of co-integrating relations.

As mentioned before, one of the basic assumptions in GVAR models is that foreign variables should be exogenously weak. The results of testing weak exogeneity for the set of selected countries are presented in Table (2). The results of this table show that the weak exogenous assumption for almost all foreign variables has not been rejected in the selected countries. Therefore, foreign variables are considered as exogenously weak.

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Table (1): The Number of Co-Integration Relationships and VARX Order

Varx(p^*,q^*)	P^*	q^*	Cointeg.
ALGERIA	1	1	2
ANGOLA	1	1	2
ARGENTINA	1	1	2
AUSTRALIA	1	1	2
AUSTRIA	1	1	2
BAHRAIN	1	1	2
BRAZIL	1	1	2
CANADA	1	1	2
CHINA	1	1	2
ECUADOR	1	1	2
EGYPT	1	1	2
FRANCE	1	1	2
GERMANY	1	1	2
INDIA	1	1	2
INDONESIA	1	1	2
IRAN	1	1	2
IRAQ	1	1	2
ITALY	1	1	2
JAPAN	1	1	2
KOREA	1	1	2
KUWAIT	1	1	2
LIBYA	1	1	2
MALAYSIA	1	1	2
MEXICO	1	1	2
MOROCCO	1	1	2
NETHERLANDS	1	1	2
NIGERIA	1	1	2
NORWAY	1	1	2
OMAN	1	1	2
Qatar	1	1	2
RUSSIAN	1	1	2
SAUDI ARABIA	1	1	2
SINGAPORE	1	1	2
SPAIN	1	1	2
SWITZERLAND	1	1	2
TURKEY	1	1	2
UAE	1	1	2
UK	1	1	2
USA	1	1	2
VENEZUELA	1	1	2

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Table (2): Testing weak exogeneity of foreign variables (X*)

Country	F test	Fcrit_0.05	ys	Dps	rrs	poil
ALGERIA	F(3,18)	3/160	0/430	0/513	1/128	0/577
ANGOLA	F(3,22)	3/049	27/957	4/917	1/258	0/550
RGENTIN	F(1,20)	4/351	2/583	0/937	0/727	2/010
USTRALI	F(2,23)	3/422	0/663	0/589	0/490	0/266
AUSTRIA	F(2,23)	3/422	17/886	3/977	2/415	0/100
BAHRAIN	F(2,28)	3/340	0/066	1/935	0/276	0/013
BRAZIL	F(4,17)	2/965	1/305	2/914	3/576	0/155
CANADA	F(3,27)	2/960	1/406	3/411	2/958	1/652
CHINA	F(3,18)	3/160	2/221	1/378	1/417	1/587
ECUADOI	F(1,29)	4/183	0/012	6/825	4/345	0/353
EGYPT	F(1,29)	4/183	0/015	1/748	0/246	3/199
FRANCE	F(1,29)	4/183	2/117	3/666	2/427	0/127
GERMANY	F(3,18)	3/160	1/975	0/514	0/472	0/140
INDIA	F(2,28)	3/340	0/990	0/929	0/170	2/750
NDONESI	F(1,29)	4/183	1/790	1/127	0/000	0/824
IRAN	F(1,20)	4/351	1/979	2/567	1/316	0/000
IRAQ	F(3,18)	3/160	8/199	1/927	2/251	1/020
ITALY	F(1,24)	4/260	0/029	0/320	0/081	0/109
JAPAN	F(1,24)	4/260	0/039	0/058	1/059	0/096
KOREA	F(4,17)	2/965	0/173	0/328	0/686	0/177
KUWAIT	F(2,28)	3/340	2/881	2/990	1/217	0/022
LIBYA	F(2,28)	3/340	1/099	0/187	0/455	0/136
MALAYSI	F(2,28)	3/340	0/791	0/727	1/014	0/676
MEXICO	F(4,26)	2/743	1/296	6/462	2/280	0/409
MOROCC	F(2,28)	3/340	0/899	0/195	0/237	0/748
THERLAN	F(2,23)	3/422	7/351	3/480	1/848	0/091
NIGERIA	F(1,29)	4/183	1/982	0/746	0/020	0/002
NORWAY	F(2,19)	3/522	0/142	0/147	0/058	0/111
OMAN	F(3,27)	2/960	0/216	1/286	1/490	0/368
Qatar	F(0,21)					
RUSSIAN	F(3,18)	3/160	4/262	0/189	1/287	0/345
UDI ARAI	F(4,21)	2/840	0/483	0/071	0/990	2/712
INGAPOR	F(4,17)	2/965	0/148	0/176	0/286	1/327
SPAIN	F(1,20)	4/351	0/480	0/027	0/001	0/027
ITZERLA	F(1,20)	4/351	4/181	4/262	4/632	0/023
TURKEY	F(2,28)	3/340	0/135	0/249	1/166	0/867
UAE	F(1,29)	4/183	0/887	0/605	1/162	0/132
UK	F(3,27)	2/960	0/945	0/686	1/041	1/912
USA	F(0,30)					
ENEZUEL	F(1,29)	4/183	0/574	5/722	0/439	0/001

The significance level of the statistics is 5%.

Impact Elasticity

The elasticity effect in the GVAR model measures the simultaneous change in a domestic variable as a result of one percent change in exogenous variable in its foreign counterpart. Co-movement of variables can be measured by this elasticity in all countries. The results of the estimation of the elasticity effects of different countries are shown in Table (3).

Table (3): Contemporaneous effect of foreign variables on their domestic counterparts

Country		y	Dp
ALGERIA	Coefficient	5/078	-0/173
ALGERIA	t-ratio	2/62*	-1/004
ANGOLA	Coefficient	-0/0002	-0/011
ANGOLA	t-ratio	-0/012	-0/599
ARGENTINA	Coefficient	0/321	-0/368
ARGENTINA	t-ratio	1/495	-0/404
AUSTRALIA	Coefficient	-0/024	0/2697
AUSTRALIA	t-ratio	-0/283	0/914
AUSTRIA	Coefficient	0/791	0/439
AUSTRIA	t-ratio	4/181*	3/674*
BAHRAIN	Coefficient	0/340	0/0856
BAHRAIN	t-ratio	2/658*	1/057
BRAZIL	Coefficient	0/258	-0/037
BRAZIL	t-ratio	1/559	-0/279
CANADA	Coefficient	0.304	0.649
CANADA	t-ratio	2.902*	3.844*
CHINA	Coefficient	0/559	-0/128
CHINA	t-ratio	2/593*	-0/416
ECUADOR	Coefficient	0/985	0/276
ECUADOR	t-ratio	3/863*	0/537
EGYPT	Coefficient	0/356	0/442
EGYPT	t-ratio	6/782*	2/002*
FRANCE	Coefficient	0/239	0/867
FRANCE	t-ratio	3/531*	7/591*
GERMANY	Coefficient	1/118	0/409
GERMANY	t-ratio	8/852*	4/248*
INDIA	Coefficient	0/161	
INDIA	t-ratio	1/398	-0/172
INDONESIA	Coefficient	0/094	1/923
INDONESIA	t-ratio	1/205	3/163*
IRAN	Coefficient	0/259	-0/066

Country		y	Dp
IRAN	t-ratio	1/666	-0/448
IRAQ	Coefficient	-0/008	0/809
IRAQ	t-ratio	-0/081	1/400
ITALY	Coefficient	-0/041	0/322
ITALY	t-ratio	-0/553	2/761*
JAPAN	Coefficient	-0/049	-0/313
JAPAN	t-ratio	-0/461	-1/754
KOREA	Coefficient	0/038	0/235
KOREA	t-ratio	0/545	1/770
KUWAIT	Coefficient	11/908	0/539
KUWAIT	t-ratio	4/986*	4/044*
LIBYA	Coefficient	0/136	-0/105
LIBYA	t-ratio	0/324	-0/427
MALAYSIA	Coefficient	0/646	0/558
MALAYSIA	t-ratio	5/066*	2/433*
MEXICO	Coefficient	0/708	0/136
MEXICO	t-ratio	3/433*	1/003
MOROCCO	Coefficient	0/431	0/157
MOROCCO	t-ratio	2/611*	2/559*
NETHERLANDS	Coefficient	0/474	0/221
NETHERLANDS	t-ratio	4/077*	1/580
NIGERIA	Coefficient	-1/031	0/377
NIGERIA	t-ratio	-3/806*	1/307
NORWAY	Coefficient	0/590	1/446
NORWAY	t-ratio	1/837	3/243*
OMAN	Coefficient	0/526	1/204
OMAN	t-ratio	2/064*	7/988*
Qatar	Coefficient	-0/394	0/066
Qatar	t-ratio	-0/566	0/174
RUSSIAN	Coefficient	-1/001	0/594
RUSSIAN	t-ratio	-1/267	3/043*
SAUDI ARABIA	Coefficient	0/858	0/880
SAUDI ARABIA	t-ratio	4/241*	2/188*
SINGAPORE	Coefficient	1/174	0/233
SINGAPORE	t-ratio	4/504*	1/288
SPAIN	Coefficient	0/063	0/187
SPAIN	t-ratio	1/529	0/627
SWITZERLAND	Coefficient	0/463	0/558
SWITZERLAND	t-ratio	2/624*	4/872*

Country		y	Dp
TURKEY	Coefficient	0/703	0/521
TURKEY	t-ratio	1/555	1/534
UAE	Coefficient	-1/628	0/424
UAE	t-ratio	-6/704*	4/212*
UNITED KINGDOM	Coefficient	0/116	0/380
UNITED KINGDOM	t-ratio	1/436	3/633*
UNITED STATES	Coefficient	0/106	0/854
UNITED STATES	t-ratio	1/485	3/964*
VENEZUELA	Coefficient	0/556	0/460
VENEZUELA	t-ratio	0/970	2/432*

*The impact elasticity is significant at 0.05 level.

Impulse Response Analysis

To study the dynamic properties of the GVAR model, a one standard error increase in oil prices as an external shock is implied.

Saudi Arabia is the world's largest exporter of crude oil with a daily export of 7273,000 barrels (15.9% of total crude oil exports). Russia with 11.3% and Iraq 7.9% are the world's second and third largest oil exporters of crude oil, respectively. Iran holds 4% of the share of the world's total crude oil exports.

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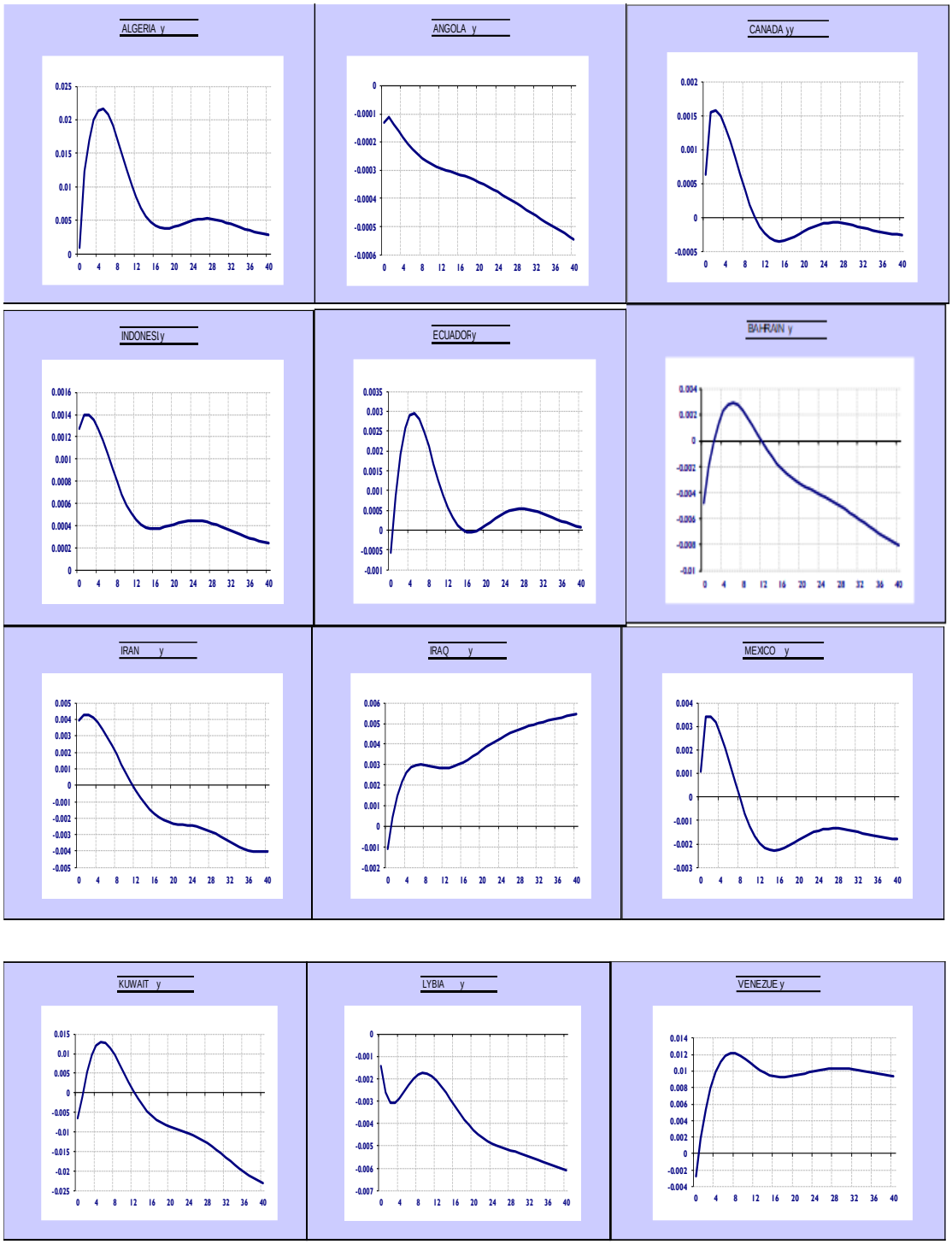

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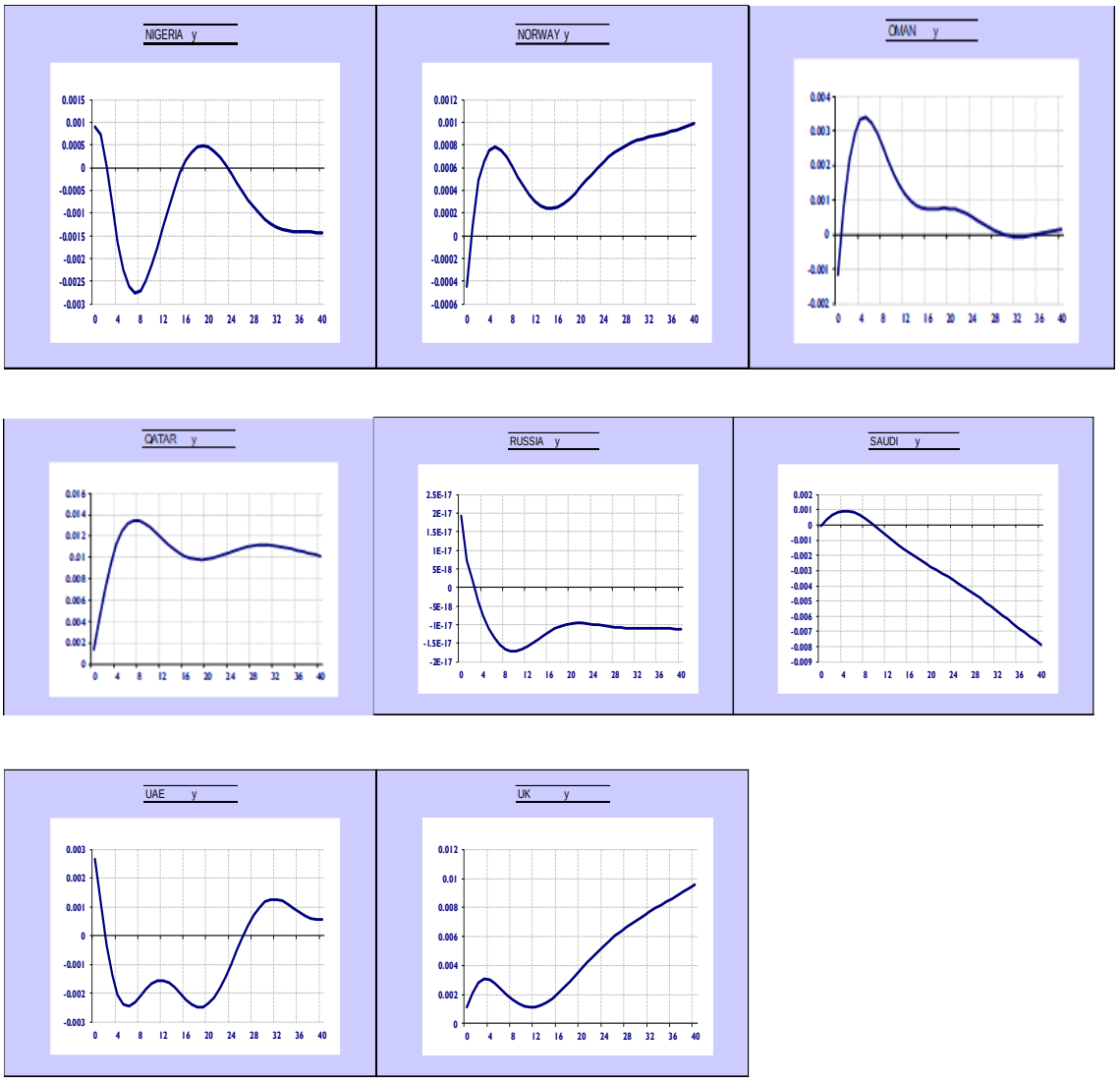

Figure (1) Generalized impulse response functions- effect of positive oil price shock on real GDP of oil exporting countries

According to the results of generalized impulse response functions (GIRF) estimated for real GDP (Fig. 1), the effect of positive oil price shock on real GDP is positive in Algeria, Ecuador, Indonesia, Iraq, Norway, Qatar, UK and Venezuela throughout the period. Likewise, Angola's and Libya's real GDP responses to the oil price shock are negative throughout the period.For Oman, there is a small negative effect on real GDP between 30th and 35thperiod. The positive effect of the oil price shock on real GDP of Mexico, Iran, Saudi Arabia, Bahrain, Canada and Kuwait is short-lived. In other words, real GDP of these countries experience negative effect from the shock in long run. Fig (1) also shows Real GDP of UAE is affected negatively between 2th and 26th quarter. It is shown that the effect of the shock on real GDP of Russia is negligible.

Overall, the impact of the oil price shock on real GDP of most of OPEC countries (Angola, Iran, Bahrain, Kuwait, Libya, Nigeria and Saudi Arabia) is negative in long

run. Saudi Arabia is the largest oil exporter among OPEC and more specifically GCC countries, which play an important role when it comes to world oil supply. Furthermore, this country has the largest spare capacity and has the global swing producer role to stabilize the oil market. Therefore, with increasing the price of oil most of the GCC countries experience a short run spike in real GDP. However, the oil export and consequently real GDP will diminish in long run.It appears that the positive oil price shock steadily increase real GDP for some oil exporters such as Venezuela that possess significant amounts of proven oil reserves. However, in Venezuela insufficient investment in energy sector and inefficient institutions result in negative effect on increasing trend of real GDP. In other word, this result is inline of the standard literature of "Dutch disease" and "resource curse".The long run decrease in real GDP of Canada is tightly related to its main trade partners' economy (USA, UK, EU) status. Increasing in the price of oil results in decreasing of demand for Canada's commodity from the trade partners of Canada that affect negatively real GDP in long run.The results of the effect of positive oil price shocks on real GDP of these countries are in line with the results of Cashin et al. (2014),Allegret et al. (2014) and Feldkircher et al. (2019).

The impact of positive oil price shock on inflation of the oil – exporting countries are depicted in (Fig. 2). As is shown, the effect of the shock on inflation of Algeria, Oman, UAE and Venezuela is negative throughout the period. However, the negative impact of the shock on inflation of Oman is negligible. Inflation of Saudi Arabia is approximately negative in all quarters[1]. Inflation of Ecuador, Indonesia, Iran, Iraq, Mexico, Nigeria, Norway, Qatar and Russia is affected positively from the shock throughout the period.Overall, the effect of the shock on inflation of the studied OECD countries (UK, Norway and Canada) and some GCC countries (Oman, UAE, Bahrain, Kuwait and Saudi Arabia) in negligible in long run. In some OPEC countries such as Iran, Iraq and Qatar, the effect of oil price shock and the achieved oil revenue will transfer to macroeconomic variables through government expense and volume of money, thus affecting the inflation. In the studied OECD countries (Canada, Norway and UK), avoiding the direct effect of oil revenue on the economy, the increasing trend of inflation rate is declined in long run (Hajebi et al., 2019).

[1]Between 5th and 8th quarter, the inflation of Saudi Arabia is affected positively from the shock

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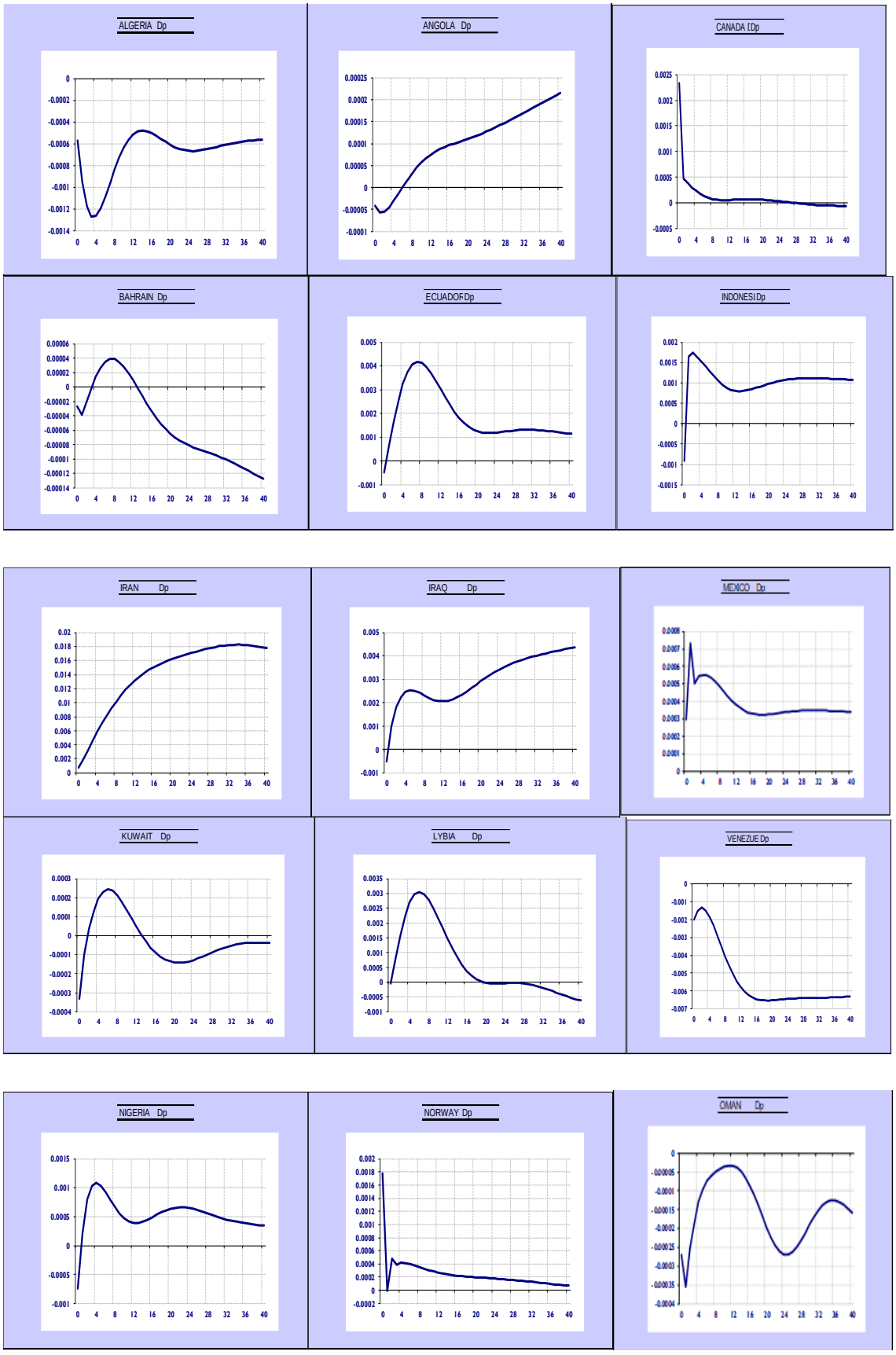

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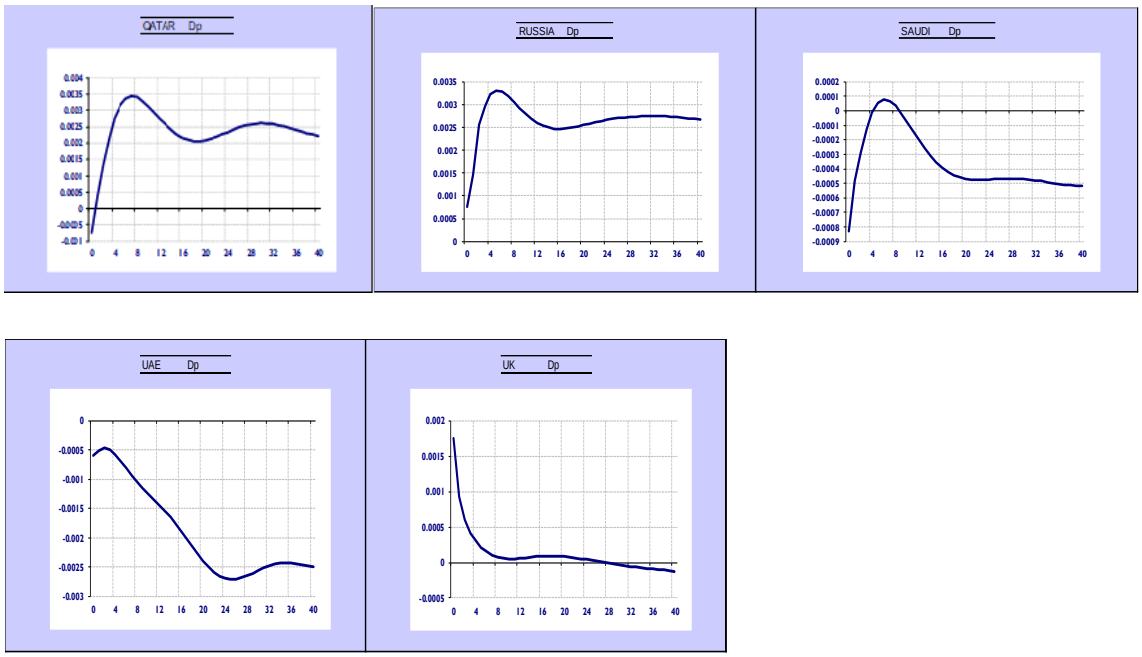
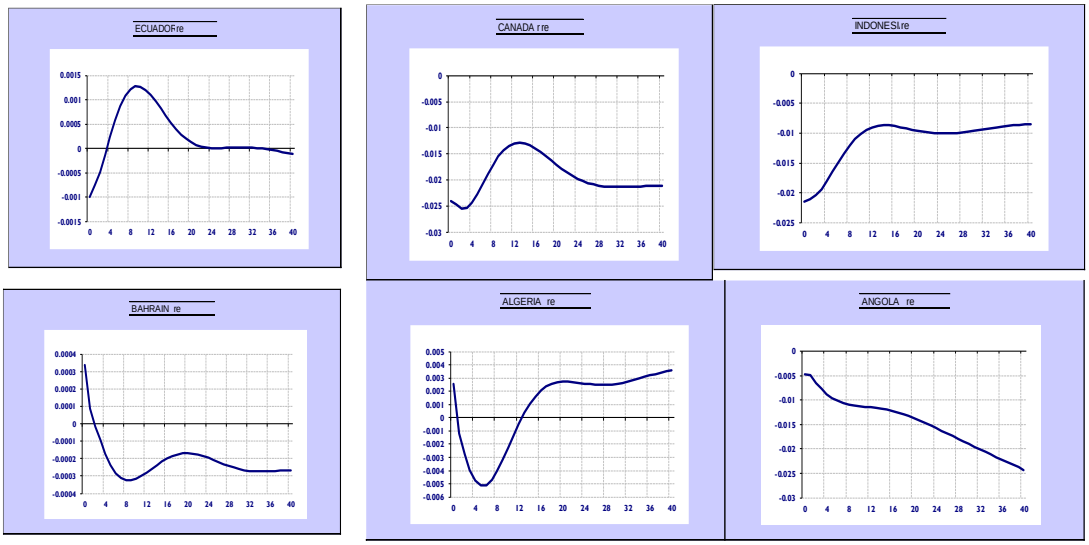


Figure (2) Generalized impulse response functions - effect of positive oil price shock on inflation of oil exporting countries



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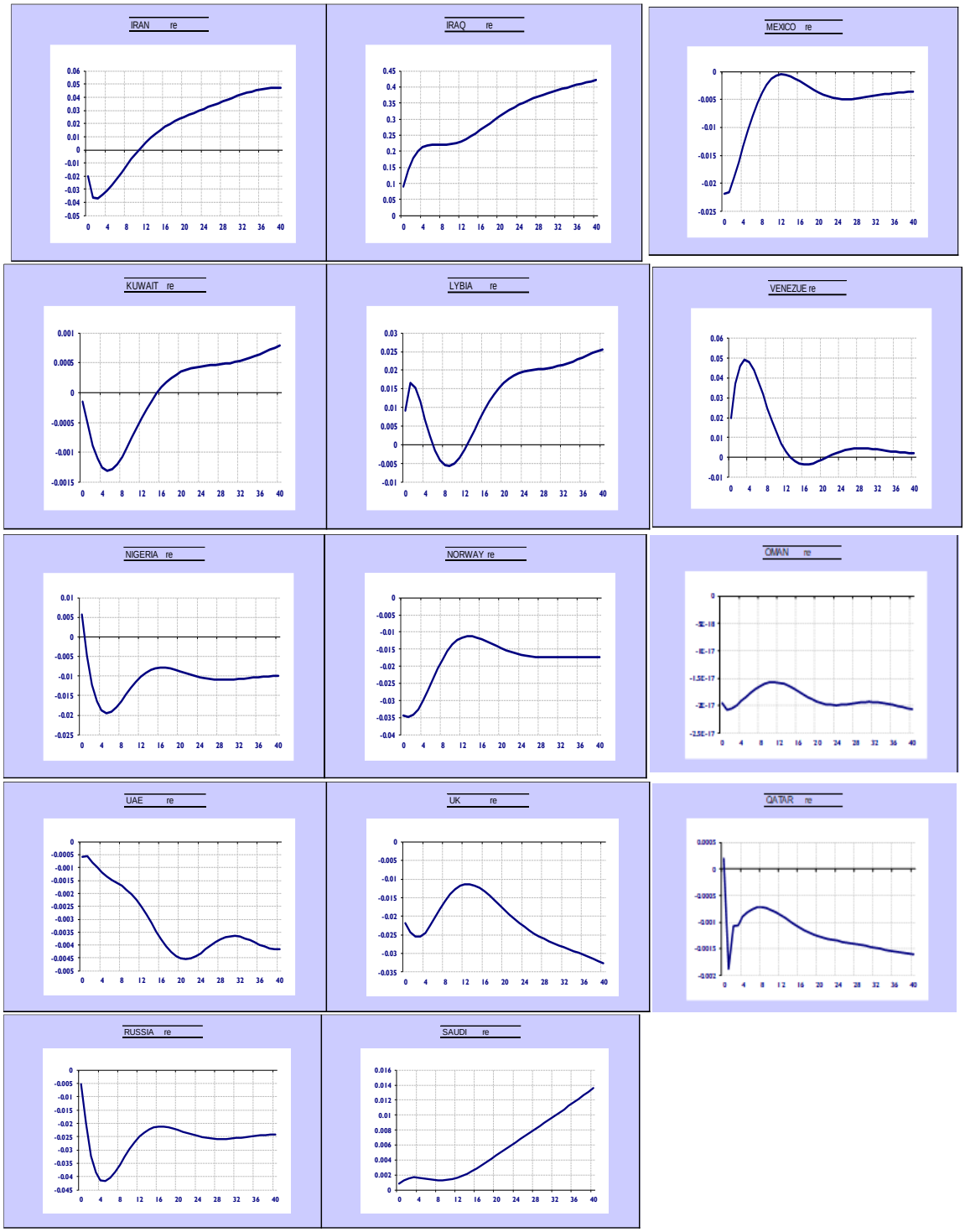

Figure (3) Generalized impulse response functions - effect of positive oil price shock on real exchange rate of oil exporting countries

Figure 3 show estimated GIRFs of real exchange rate of the oil exporters to a positive oil price shock. The consequences of the oil price shock is different across the countries. The real exchange rate of Angola, Canada, Indonesia, Mexico, Norway, Oman, Russia, UAE and UK affected negatively by the oil price shock throughout the period. However, the negative effect of the shock on real exchange rate of Oman is negligible. In contrast, Venezuela, Saudi Arabia and Iraq experience positive effect throughout the period. The real exchange rate of Iran is affected negatively between the 1th quarter and 10^{th} quarter, however the effect of the shock is positive after 10^{th} quarter. The reason behind of the negative effect of the oil price shock on real exchange rate of the most oil exporters is described with the increasing of the value of national currency which followed by effects of Dutch disease. The negative effect of the shock on real exchange of Iran and Algeria in short run is related to increasing oil revenue followed by rising the general level of prices. However, in long run the import will increase that resulted in increasing demand of foreign currencies lead to gradually increment of real exchange rate.

Conclusion

This paper investigates the effects of oil price shock on real GDP, inflation and real exchange rate of major oil exporting countries over the period 1974Q1 to 2019Q4 by using GVAR approach. Generalized Impulse response analysis reveals that all countries are affected differently by oil price shocks. In the long run the impact of this shock is positive and significant on the GDP of countries such as Qatar, Venezuela, Algeria and Ecuador that possess significant amount of proven oil reserves and for which the reserve-to-production ratio is large. In these countries, oil revenue is the major share of government budget hence the effect of the oil price shock on macroeconomics will transfer through government expenses and liquidity. The negative effect of the oil price shock on real GDP of Iran and Nigeria can be explained by the negative relation between investment and the oil price and being inline of resource curse.

Some GCC countries such as Saudi Arabia uses its spare capacity to inject oil into the market when global oil supply falls. Therefore, following the positive oil price shock, some GCC countries initially experience a short run increase in their GDP, but over the medium term and long term and adjusting the oil supply flow, these countries cut back from their production and export which result in decreasing of GDP.In contrast, the real GDP of major OECD oil-exporters (UK and Norway) positively affected by the oil price shock. The reason is related to the developed economic base of these countries and using the oil revenue in investment and production.For many of the major oil-exporting countries that began oil extraction and export in the early twentieth century, the ratio of oil reserves to extraction indicates that even if they will not discover new oil fields or access to new oil extraction technologies, these countries will be able to produce this vital substance for decades.

The impact of the oil price shock on the inflation of the most of the oil-exporting countries is. One of the reasons for inflationary pressures in oil-exporting countries is the tendency of the real exchange rate to rise when oil prices increase. In these countries with rise in price oil, the oil revenue will increase. If the large amount of the achieved

revenue injected in government budget, import of goods increases that results in long run inflationary pressures.

The impact of the oil price shock on the real exchange rate of the most oil-exporters is negative. The difference is related to the complex mechanisms of monetary and fiscal policies, the exchange rate regime, the degree of freedom of trade, economic development and the existence of nonlinear factors in the product and labor markets.

Therefore, it is suggested that in oil exporting, the major import should be allocated to the import of capital goods required by the industry. Trade policies also need to be adjusted to increase the degree of trade openness. These countries also need to adopt policies to convert foreign exchange earnings from oil export to avoid inflationary pressures and devaluation of the national currency. In the presence of oil price shocks to maintain economic stability considering interdependencies between all countries around the world, oil importing countries need to find alternative fossil fuel and while maintaining effective interaction with oil-exporting countries, they need to seek new sources of energy outside specific areas and provide effective solutions to maintain peace and stability in oil-rich areas.

References

Allegret, J., Mignon, V., & Sallenave, A. (2014). Oil Price Shocks and Global Imbalances: Lessons from a model with trade and financial interdependencies. *CEPII Working Papers*.

Baumeister, C., & Peersman, G. (2013a). The Role of Time-Varying Price Elasticities in Accounting for Volatility Changes in the Crude Oil Market. *Journal of Applied Econometrics*, 27(8), 1087- 1109.

Buriel, P., & Galesi, A. (2018). Uncovering the Heterogeneous Effects of Unconventional Monetary Policies Across Euro Area Countries. *European Economics Review*, (101), 201-229.

Cashin, P., Mohaddes, K., Raissi, M., & Raissi, M. (2014). The Differential Effects of Oil Demand and Supply Shocks on the global Economy. *Energy Economics*, (44), 113-134.

Chudik, A., & Pesaran, M. (2014). Theory and Practice of GVAR Modelling. *Journal of Economic Surveys*, 165-197.

Cuaresma, C., Feldkircher, M., & Huber, F. (2018). Forecasting with Bayesian Global Vector Autoregressive Models: A comparison of Priors. *Journal of Applied Econometrics*, 1371-1391.

Dees, S., Di Mauro, F., Pesaran, M., & Smith, L. (2007). Exploring the International Linkages of the Euro Area: A global Var Analysis. *Journal of Applied Econometrics*, (22), 1-38.

Di Mauro, F., & Pesaran, M. (2013). *GVAR Handbook-Global VAR Modelling.* Oxford: Oxford University Press.

Esfahani, H., Mohaddes, K., & Pesaran, M. (2014). An Empirical Growth Model for Major Oil Exporters. *Journal of Applied Econometrics*, 29(1), 1-21.

Feldkircher, M., & Siklos, P. (2019). Global Inflation Dynamics and Inflation Expectations. *International Review of Economics and Finance*, (64), 217-241.

Galesi, A., & Lombardi, M. (2009). External Shocks and International Inflation Linkages: AGlobal VAR Analysis. *Eurosystem*, 1-45.

Greenwood, M., Nguyen, V., & Shin, Y. (2012). Probabilistic Forecasting og Output Growth, Inflation and the Balance of Trade in an GVAR Framework. *Journal of Applied Econometrics* , 554-573.

Hajebi, E., & et al. (2019). Effect of U.S. Monetary Policy Shock on GDP of Oil-exporting Countries: GVAR Approach. *Journal of Econometric Modeling*, 4(4), 59-84.

Hamilton, J. (2013). Historical Oil Shocks. *Handbook of Major Events in Economic History*, 239-265.

Iacoviello, M., & Navarro, G. (2018). Foreign Effects of Higher U.S. Interest Rates. *Journal of International Money and Finance*, (30), 10-25.

Jahadi, M., & Elmi, Z. (2011). Oil Price Shocks and GDP (Evidence from OPEC Countries). *Qusrterly Journal of Economic Growth and Development research*, 1-40.

Kilian, L., & Murphy, D. (2014). The Role of Inventories and Speculative Trading in the Global Market for Crude Oil. *Journal of Applied Econometrics* , 29(3), 454-478.

Mohaddes, K., & Pesaran, M. (2015). Country Specific Oil Supply Shocks and the Global Economy: A CounterFacual Analysis. *Economic Research Forum 21st Annual Conference, Tunisia*.

Mohaddes, K., & Raissi, M. (2018). The U.S. Oil Supply Revolution and the global Economy. *Empirical Economics*, 1-32.

Najafi, I., Moghaddasi, R., & Zeraatkish, S. (2016). Factors Affecting Export Prices of Major Pistachio Exporting Countries Using Global Vector Autoregression Model. *Journal of Agricultural Economics Research*, (3),193-216.

Pesaran, M., Schuermann, T., & Weiner, S. (2004). Modeling Regional Interdependencies Using a Global Error-Correcting Macro Econometric Model. *Journal of Business and Economics Statistics*, 22, 129-162.

Smith, L., & Galesi, A. (2014). *GVAR ToolBox 2.0*. Cambridge: University of Cambridge: Judge Business School.

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