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Macro and Sectoral Implications of Oil Price Decrease on Oil-Exporting Countries

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El Mostafa Bentour

Abstract

This paper assesses the effects of a negative oil price shock on the real GDP and its demand and supply components for nine Arab oil-exporting countries, namely, Algeria, Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Using a Bayesian Vector Autoregressive (BVAR) approach, the paper assesses the effects of oil price decreases on all other real sectors than the oil sector. On the demand side, this study dealt with a quantitative assessment of the impact of the decline in oil prices on the real variables of: GDP, total imports of goods and services, non-oil exports of goods and services, total private consumption, government consumption and total investments. From the supply side, the effects were assessed considering the manufacturing sectors, the construction sector, the whole sale and tourism services, the transport and communication services and other services that includes financial and banking services.

Results show that, generally, the real sectors (excluding oil sectors) in major oil-exporting countries are more vulnerable to the oil price fluctuations and the demand and supply sectors as well are highly affected by the oil price decreases. Consequently, it is important to build more resilience towards oil fluctuations by building a fiscal policy that stems mainly from diversifying sources of government revenues through other sources of income. As the process of diversification advances creating more non-oil revenues, this leads to gradually decoupling changes in public spending from changes in oil prices.

الانعكاسات الكلية والقطاعية لانخفاض أسعار النفط على الدول المصدرة له

المصطفى بنتور

ملخص

تقيم هذه الورقة آثار تراجع أسعار النفط على الناتج المحلي الإجمالي الحقيقي ومكوناته من جانبي العرض والطلب لتسع دول عربية مصدرة صافية للنفط، وهي الجزائر والبحرين والعراق والكويت وليبيا وعمان وقطر والمملكة العربية السعودية والإمارات العربية المتحدة. باستخدام نماذج "الانحدار الخطي المتجهي البايزية" (BVAR)، تقدر الورقة آثار انخفاض أسعار النفط على جميع القطاعات الحقيقية الأخرى غير قطاع النفط. على صعيد الطلب، تناولت هذه الدراسة التقييم الكمي لتأثير انخفاض أسعار النفط على المتغيرات الحقيقية للناتج المحلي الإجمالي، والواردات من السلع والخدمات، والصادرات غير النفطية من السلع والخدمات، والاستهلاك الخاص، والاستهلاك الحكومي، والاستثمار. من ناحية العرض، تم تقييم الآثار مع الأخذ في الاعتبار قطاعات التصنيع، وقطاع البناء والتشييد، وقطاعات خدمات التجارة والسياحة والنقل والاتصالات، والخدمات الأخرى التي تشمل الخدمات المالية والمصرفية.

عموماً، تظهر النتائج أن القطاعات الحقيقية (باستثناء قطاعات النفط) في الدول المنتجة للنفط، هي أكثر عرضة لتقلبات أسعار النفط، كما أن قطاعي العرض والطلب يتأثران بشدة بانخفاض أسعار النفط. بالتالي، من المهم بناء المزيد من المرونة تجاه تقلبات النفط من خلال تبني سياسة مالية تنبع بشكل أساسي من تنويع مصادر الإيرادات الحكومية من خلال مصادر دخل أخرى. مع تقدم عملية التنويع في خلق المزيد من الإيرادات غير النفطية، سيفضي ذلك إلى فصل التغيرات في الإنفاق العام تدريجياً عن تقلبات أسعار النفط.

Contents

1. Introduction

Oil prices variations are mainly determined by a variety of factors that can be originated from four principal sources. First, supply production surges/disruptions driven by refining capacities expansion, OPEC or major oil producing decisions, climate disasters, as well as the rhythm of oil exploration. Second, demand factors driven by world GDP as well as population growth rates. Third, international macroeconomic environment through the exchange rates system and interest rates. Fourth, speculations due to uncertainty factors and future contracts in the oil markets. These combined factors have contributed to high oil price oscillations between positive and negative shocks over the past fifty years, although the general trend level is increasingly continuous over time until 2013.[1]

Nevertheless, developments in oil prices since September 2014, tend to differ from their predecessors as the decrease to low or moderate levels shocks have tendency to persist over time. In 2020, despite the OPEC efforts to cut the oil production to historical levels to revive the oil prices following the COVID-19 spread,[2] technical issues related to onshore storage capacities played an additional downward pressure to further push the prices to unprecedented low levels (Deloitte, 2020). Following these developments, impacts on the fiscal and trade balances of the oil exporting countries in terms of revenue losses are substantial (Wheeler, 2020). For most of the Arab oil dependent countries, revenues from hydrocarbon products constitute in some countries more than 50% and have a dominant share in the oil exports accounting for more than 80% (Deloite, 2020, Menichetti and others, 2018).

Consequently, while these countries (particularly the GCC group) accumulated fiscal reserves in time of high oil prices allowing them to build strong fiscal buffers and enjoy a high standard of development and living,[3] oil negative shocks threaten their public finance sustainability incurring substantial losses in billions of US$ (Deloitte, 2020). All these developments reinforce the importance of a serious and sustainable trend towards diversifying sources of income in the medium to long run. Besides, if such losses are directly and easily estimated, their macro and sectoral implications are not straightforward measurable.

The purpose of this paper is to assess the sectoral effects of a negative oil price shock on the Arab oil-exporting countries. The study focuses on particularly nine net oil-exporting countries in the Arab region namely; Algeria, Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

[1] Important analyses about these factors could be found for example in Kilian (2009), Maugeri (2012), and Baumeister and Kilian (2016).
[2] The Guardian, April 12, 2020.
[3] For example, the human development index of the United Nations ranks the GCC countries in the first category of countries enjoying very high level of development (Human Development Report, 2020).

In addressing impacts assessment, a variety of models based on the standard Vector Autoregressive models are used. While the latter enjoys a growing popularity and use particularly in studying the impact analysis through the dynamic of the variables' behaviours described by the data, their issue resides mainly in their requirement for the increasing degrees of freedom with the number of the parameter to estimate. In particular, the higher the number of the variables and/or the number of lags, the larger the time series length required to estimate these models. To deal with this issue, particularly reducing the number of parameters in VAR models, inference techniques were developed to impose restrictions on some of these coefficients. Such method is known as *shrinkage method*. The restrictions are based on Bayesian information and the obtained VAR model is called Bayesian VAR or BVAR model.[4]

Using the Bayesian VAR approach, we especially assess the effects of an oil price decrease on the Gross Domestic Product and its breakdown into demand as well as supply components. On the demand side, this study dealt with a quantitative assessment of the impact of the decline in oil prices on the real variables of; GDP, total imports of goods and services, non-oil exports of goods and services, total private consumption, government consumption and total investments. From the supply side, the effects were assessed considering the manufacturing sectors, the construction sector, the whole sale and tourism services, the transport and communication services and other services that includes financial and banking services.

The remainder of the paper is as follows: The second section summarizes the key literature on the oil price shocks effects, the third section presents the econometric methodology, the fourth section the data, the fifth section displays the results, the sixth section provides a discussion and some policy recommendations, and the seventh section concludes.

2. Literature review

Over the last recent years, developments in oil prices after September 2014, differ from their predecessors as the decrease to low or moderate levels shocks have tendency to persist over time. This is mainly due to drastic changes in both oil demand and supply sides. On the supply side, there is generally a shared view pointing to the shale oil surge as a main driver contributing to keep oil prices in their low levels, despite that this view seems not supported by empirical evidence (Foroni and Stracca, 2019). On the demand side, the main factors are due to low growth rates in major oil consuming countries developed and emergent as well. These factors contributed simultaneously to the collapse of oil prices at the starting from September 2014.[5]

An important strand of the oil prices literature was dedicated to explaining the oil sources variation and shocks. Examples of papers describing and analyzing the historical oil price shocks and their

[4] Description of the theoretical methodology is presented in section 3.

[5] In 2012, an important study issued by the Belfer Center for Science and International Affairs, in the Kennedy Institute belonging to Harvard University (Oil: The Next Revolution) was one of the most accurate studies predicting the sustained oil prices at their levels until 2020.

origins are: Kilian (2009), Maugeri (2012) and Baumeister and Kilian (2016). Accordingly, besides the economic drivers, investment and explorations, development in shale production, logistics and geopolitical factors, the speculation factor is constituting an important source of oil price volatility. Speculation fuel expectations about demand and supply which could explain about one third of oil price volatility (Arezki and others, 2014; Baumeister and Kilian, 2016; Fueki and others, 2020).

Developed and developing countries alike are sensitive to the oil prices effects. The latter have thoroughly been investigated as their impacts are affecting differently countries, depending on whether these are net importing or net exporting of this vital commodity. On the net importing countries, the tendency of the studies focuses mainly on the effects of the increase of oil prices which could weigh on the government current account balances and public finances through subsidized oil products.[6] However, while the negative oil price shocks have tendency to benefit to net importing countries, it deprives the oil exporting countries from their principal source of revenues.

The macroeconomic effects of oil prices have been proliferated across variables and behaviors leading to a large body of literature that examined the effects of the oil price shocks and its volatility. On the macroeconomic level, researchers interested particularly in the effects of the oil prices on economic growth (Tatum, 1987; Hamilton, 2003; Kilian, 2009; Peersman and Van Robays, 2012; Baumeister and Peersman, 2013; Cashin and others, 2014; Van de Ven and Fouquet 2017). Generally, the effects of a decline in oil prices tends to raise the output of the net oil importing countries while hurting the net oil exporters but the magnitude of such effects differs across countries.

Furthermore, researchers also investigated the effect of oil prices on the consumption behavior and inflation (Gelos and Ustyugova 2012; Bentour, 2016), on the stock markets returns (Bentour, 2014; Kang and others, 2014; Salisu and Gupta, 2021), as well as affecting other international commodities' prices such as gold (Demirer and others, 2020) and domestic prices alike through imported inflation. Oil prices can also affect and shape the way economic policies (i.e. fiscal, monetary and exchange rate policies) are designed across countries.[7] Beside its direct impact on the current account through the trade balance components, oil prices may also have an impact on the exchange rate. Indeed, a decrease (an increase) in oil prices is likely to depreciate (appreciate) the currency of a net oil-exporting country (oil-importing country). In this regard, Arezki and Blanchard (2015) showed that the 2014 oil price decrease leads to an exchange rate depreciation of more than 40 percent of the Russian Ruble. Oil prices may also affect firm's productivity and

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[6] Until 2013, oil derivatives products are subsidized in many Arab countries. However, the high levels of oil prices around the period of 2010-2013 urged many countries to reform and review their policy subsidies.

[7] For more details, readers could consult, for example; Bower and others (2007), Wadhwani (2008) and, Bentour and Razzak (2010), for the monetary policy and oil prices; Filardo and others, 2018, Bower and others (2007) and Bentour (2020), for fiscal policy and oil prices effects.

profit particularly for oil companies as well as affecting the profitability of the financial and banking sector (Hesse and Poghosyan, 2009; Arezki and Blanchard, 2015).

For the MENA countries and particularly the Arab region oil-exporting countries, the 2020 dual shock of COVID-19 crisis and oil prices decline induced substantial twin deficits (fiscal deficit and current account deficit) for all the Arab oil producing and exporting countries (World Bank, 2020). Oil price decline losses are reflected statistically in the values of oil exports (from the demand side), the value added of the oil production and refining sector from the supply side, as well as the government oil revenues from the government finance perspective. However, the effects of oil price decreases on the real sectors (other than oil exports, petroleum production value added sector and oil revenues) are not straightforward measurable, as there are other interfering indirect economic factors and behaviors.

The impacts of the oil prices on importing as well as exporting countries is assessed through different methods and models. In this regard, Vector autoregressive (VAR) models and their enhanced versions (Structural VAR; SVAR, Bayesian VAR; BVAR) as well as input-output and CGE models are widely used. For example, using a BVAR model for the United States economy on quarterly data, Fry-McKibbin and Zhu (2021) evaluate the impacts of oil supply and demand shocks on seventeen economic variables. The study shows adverse effects over many macroeconomic variables particularly the stock market variables while generating permanently inflationary pressures. For the input-output models, Bentour (2016) used this technique to assess the inflationary pressures on the Moroccan economy following the reform that removed the subsidized prices of the oil derivatives.

3. Methodology: The Bayesian VAR (BVAR) model

Bayesian statistical analysis involves information on the property's distribution of the prior and posterior likelihood. Uncertainty about the true values of the parameters, leads to assume such parameters as variables, randomly distributed. The prior is determined by econometricians considering their credence and belief on these parameters, as the external distributional information. The data information in the sample probability distribution function defines the likelihood, which, combined with the prior distribution through Bayes' theorem leads to the posterior distribution.

Considering a given model generating the parameters of interest by $\eta = (\alpha, \Psi)$ and data by z. Let $\varphi(\eta)$ be the prior distribution, called also the hyperprior, and $l(z/\eta)$ the likelihood. The posterior distribution $\varphi(\eta/z)$ is the distribution of η given data z, which could be formulated as $\varphi(\eta/z) = \frac{\varphi(\eta)\, l(z/\eta)}{\int \varphi(\eta)\, l(z/\eta) d\eta}$.

The denominator part $\int \varphi(\eta)\, l(z/\eta) d\eta$ is a constant (not random), and the posterior is then proportional to the product of the likelihood and the prior $\varphi(\eta/z)\ x\ \varphi(\eta)\ l(z/\eta)$. Principally, Bayesian estimation aims at determining the posterior moments of the parameter of interest.

With relation to Bayesian VAR (BVAR) models, suppose that we have a standard VAR. The latter was proposed by Sims (1980) as an alternative to the large-scale structural macro econometric (Keynesian) models criticized by Lucas (1976) to lack the ability to predict agents' behaviors following changes in economic policies. In their reduced form, VAR models are defined such as N variables of a vector Y supposed to well describe the dynamic behavior of a sector or a subsector of the economy. Each variable of the vector is linearly dependent variable to its past and the past of the other variables of the Y vector, which we formulate as the following:

$$Y_t = C + \sum_{i=1}^{m} A_i \, Y_{t-i} + \epsilon_t$$

With: Y_t, a N$\times$ 1 vector of endogenous variables, C a $N \times 1$ vector of constant terms and ε_t, an $N \times 1$ vector of error terms assumed with classical properties (independent and identically distributed, $\epsilon_t = iid(N, \Sigma_\epsilon)$. The matrix of coefficients A_i (with dimension $N \times$ N) is estimated for every $i = 1, \ldots, m$, with m is the maximum lag length of the VAR determined by a set of statistical information criteria.[8] In this VAR, the posterior distribution $\alpha \equiv vec([C, A_1, \ldots, A_m])$ is centered at the OLS estimates of the coefficients with flat priors and easily computable, but generate poor out-of-sample forecasts. Improving the quality of the predictions in a VAR, Doan and others (1984), Litterman (1980;1986) and Sims and Zha (1998) developed many methods especially those based on incorporating restrictions via prior probability distributions. A popular method is the "Minnesota prior" or the "Litterman prior" are one popular approach for achieving shrinkage, since Bayesian priors provide a logical and consistent method of imposing parameter restrictions. The Bayesian analysis focuses on including prior information that supports inference concerning the parameters' true value. Econometric software offers other techniques to implement such priors.[9]

For the Litterman or Minnesota prior, the implementation is to fill the priors of the prior distribution $\varphi(\eta)$, which are called hyperparameters (μ, λ_1, λ_2, λ_3), standing respectively for the tightness of the prior mean, the overall tightness on the variance (of the first lag), the relative tightness of the variance of other variables, and, the relative tightness of the variance of the other lags.[10] The determination of these parameters are mainly subject to ad-hoc literature and discussions. For the Litterman/Minnesota prior method, the prior mean μ should be close to zero as it is expected to have most or all of all its elements set to zero to lower the risk of over-fitting. Setting λ_1 small leads to prior information dominating the sample information, whereas $\lambda_2 = 0$

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[8] A variety such tests allowing to detect lag length are; the Final Predictor Error (FPE), the Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), the Hannan-Quinn (HQ) and sequential modified Log likelihood Ratio test (LR). The presence of the lags and temporal interdependencies in the VAR specification ensure the dynamic of such models and make them a powerful tool in studying the impacts of a variable over the others in the system, through the so-called "*impulse response functions*".

[9] In Eviews, there are four methods allowing to determine the prior information: 1- the Litterman/Minnesota prior, 2- the normal-Wishart prior, 3- the Sims-Zha normal-Wishart prior, and 4- the Sims-Zha normal-Flat prior.

[10] More details about Bayesian techniques and background theoretical technicalities are well presented in Ciccarelli and Rebucci (2003), Geweke and others (2011), Del Negro (2011) and Giannone and others (2012).

reduces the VAR to a vector of univariate models. λ_3 represents the relative tightness of the variance of lags. For example, Kadiyala and Karlsson (1997) set $\lambda_3 = 1$ and Koop and Korobilis (2009) set $\lambda_3 = 1$. Based on this, we used the Litterman/Minnesota method with hyperparameters $(\mu, \lambda_1, \lambda_2, \lambda_3)$= (0,0.1;0.9;1).

For our study, we established two Bayesian VARs (BVARs) for each country: the demand BVAR and the supply BVAR model each with six variables. We particularly assess the impact on the real GDP, the domestic demand and foreign demand of non-oil exports. The domestic demand is represented by the final households' consumption, the government consumption, the total investment and the imports of goods and services. The second model assesses from a supply side perspective, the effects of a negative oil price on the real GDP, and its major components that are manufacturing industries, construction sector as well as three important categories of services namely, "wholesale, retail trade, restaurants and hotels," "transport, storage and communication" and, "Other services." The stability of the VAR model requires all the endogenous variables to be stationary, which is checked by elaborated tests particularly the Augmented Dickey-Fuller and Phillips-Peron tests. For the current exercise, appendix 1 presents the stationary results for an ADF test conducted for all the series of the model and the oil price times series in level as well as in first differences. These results show clearly that all the series are integrated of order one. Thus, the variables are introduced in first differences of the logarithm levels.

4. Data sources and a brief analysis of oil prices developments

4.1 Data sources

The data variables are obtained from United Nations Conference on Trade and Development (UNCTAD) database[11] for a sample of time series starting from 1970 until 2018.[12] We particularly download annual GDP data and its breakdown by type of expenditure, and the corresponding total value added and its breakdown by kind of economic activity. The latter is classified into 3 groups: agriculture, industry (Mining, Manufacturing, Utilities and Construction) and services (Wholesale, retail trade, restaurants, and hotels; Transport, storage and communications, and all other services). For the oil prices data, there are many sources that provide the average annual crude oil prices in United States Dollars per barrel. We choose the sources that display the nominal prices as well as the adjusted for inflation oil prices for a long period covering the sample period of this study (1970-2020).[13]

4.2 A brief analysis of oil prices developments

Over the last 50 years, oil prices, whether nominal or adjusted for inflation, witnessed fluctuations that may not be witnessed in other commodities. The average volatility over the period 1970-2020

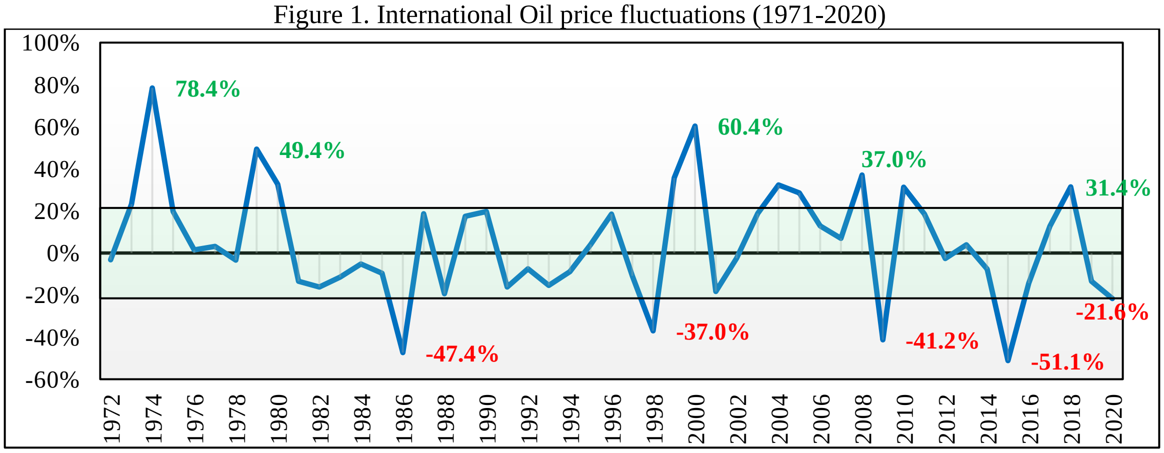
[11] https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx.

[12] More details on data methodology are accessible through the link: https://unstats.un.org/unsd/snaama/assets/pdf/methodology.pdf.

[13] Data are from https://inflationdata.com/articles/inflation-adjusted-prices/historical-crude-oil-prices-table/

is about 29 percent for the nominal prices and around 26 percent for the adjusted for inflation prices (figure 1). Besides, the number of negative shocks (oil price negative growth rate) versus the number of positive ones (on annual basis) are almost equal over the whole period. We account 24 negative shocks and 26 positive shocks. Among these price changes, about 30 percent are relatively large shocks with their size exceeded the overall standard deviation of 26 per cent over the period 1970-2020. However, during the last seven years, negative shocks are dominant. In this regard, we recorded 5 negative shocks and 2 positive shocks over the period of 2014-2020.

Figure 1. International Oil price fluctuations (1971-2020)



Note: In this figure, we display the values of the top five positive shocks and the top five negative shocks as well as a colored (light green) band representing the range of the volatility (oil price growth rates) between -20% and 20%.
Source: constructed by the author from https://inflationdata.com/articles/inflation-adjusted-prices/historical-crude-oil-prices-table/

5. Results

The historical average volatility over the period 1970-2020 for oil prices is 0.29 (the standard deviation of the oil prices growth rate). Consequently, this section summarizes the BVAR model results of the demand sectors (table 1) and supply sectors (table 2) in response to a negative shock of an equivalent innovation of -30% decrease in oil prices volatility. The graphical responses of all variables to such a shock are displayed for each country from figure 2 to figure 10.

5.1 Impacts on the aggregate demand components.

Table 1 (and figures 2-10, blue background parts) shows the results of a negative oil price shock on the real components of the demand. Generally, a decrease in oil price is likely to reduce the real GDP by affecting, from the first year of the shock, principally the three components of the domestic demand: the final consumption, the government consumption and the investment (Gross capital formation). As a result, real GDP is negatively affected in the net oil-exporting countries starting from the first year of the shock, except for Algeria where the negative effect is happening and highly emphasized in the second year of the shock.

5.2 Impacts on the aggregate supply components

On the supply side, table 2 (and figures 2-10, green background parts) shows the results for negative oil price shocks on respectively, the real GDP, manufacturing industries, construction sector as well as three important categories of services namely, Wholesale, retail trade, restaurants and hotels, Transport, storage and communication and Other services. For the total real GDP, the impact is negative for Algeria, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The supply side model confirms the positive effects for Bahrain.[14] The impact on real manufacturing industries is negative for Algeria and Oman for the first and second years, negative Bahrain and Saudi Arabia in the first year and positive in second year, and, negative in the second year for Iraq, Kuwait, Libya and Qatar. For the construction sector, there is a negative effect during the first and second years of the shock except for Bahrain (positive in the first and negative on the second). For the “wholesale, retail trade, restaurants and hotels” sector, the impact is negative on all countries except in Bahrain. Finally, the sectors of “transport, storage and communication” and “Other services”, are clearly negatively affected by the negative oil price shock particularly in the second year following the shock.

6. Discussion and policy recommendations

The overall results show a reasonable trend of what is expected as macroeconomic and sectoral effects from a negative oil price shock on oil-dependent countries. Nevertheless, some assumptions need to be mentioned. The undertaken exercise relies on the data interdependencies but omit other factors directly or indirectly related to the channels by which oil prices affects the macroeconomic variables. These variables and factors, which are surrounded by uncertainty factors associated with the future of oil prices, may contribute to an increase in the margins of error in the impact assessment. The assumptions are made on the oil prices without considering the change in the quantities that could be made by some or all studied countries to compensate partially or totally the lost due to prices decrease; that is, all changes will be the result of changes in the price of oil. Given the negative oil price shocks on the overall sectors of the major oil exporting countries, this leads to conclude that the oil price is still playing an important role in the oil producers’ economies, particularly the net exporting countries.

Following the current discouraging developments in the oil prices and their persistency in low levels, the main implicit recommendation to be mentioned, is the need to build more resilience towards oil fluctuations. This requires a fiscal policy that stems mainly from diversifying sources of revenues. This diversification, in turn, stems from the diversification of sources of income in goods and services, particularly by continuously reforming the systems of taxation, energy subsidies and enhancing the private sector share in the economy. Furthermore, diversifying the

[14] Although this result was not expected for Bahrain, is also reported by another study (Alkhateeb and Mahmood, (2020) found a negative relationship between oil prices and the trade balance). The produced oil quantity in Bahrain is relatively small compared to other countries (about 0.20% as a share of the total production of the 10 considered countries in 2019).

production structures leads to more tax revenues while having an efficient and mature tax system leads to adjust revenues to business cycle fluctuations by the work of the automatic stabilizers. The consequence of this is to decouple changes in public spending from changes in oil prices. At the same time, it is vital to continue enhancing a friendly environment for total investments (domestic and foreign as well) which seems to be highly the most affected by the oil price decrease (as reported by the study results).

7. Conclusion

This paper evaluated the effects of the decline in oil prices on the real GDP and its demand and supply components for particularly some major oil exporting countries using a Bayesian Vector Autoregressive (BVAR) model. We particularly considered a sample of nine oil-exporting countries namely, Algeria, Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

The overall results show that the real sectors (from the demand as well as supply sides) are negatively impacted by a negative oil price shock for the major exporting countries. Therefore, it is necessary to continue achieving the diversification process, as well as the subsidy and tax reforms, even in the situation where oil prices tend to rise, due to the importance of linking sources of income to non-rentier sources. Most importantly, this should lead to sources of income that depend on the variables determined internally (endogenously), through higher productivity and skilled human capital, thus reducing dependence on external variables and shocks.

8. References

Alkhateeb T. Y. and Mahmoud H. (2020). “The Oil Price and Trade Nexus in the Gulf Co-Operation Council Countries.” *Resources*, vol. 9(139). MDPI.

Arezki R. and Blanchard O. (2015). “The 2014 oil price slump: seven key questions.” *VoxEU*.org, January 13. https://voxeu.org/article/2014-oil-price-slump-seven-key-questions.

Arezki R., Loungani P., van der Ploeg R. and Venables A. (2014). “Understanding international commodity price fluctuations”. *Journal of International Money and Finance*. Vol. 42, p. 1-8.

Baffes J., Kose M., Ohnsorge F. and Stocker M. (2015). “The Great Plunge in Oil Prices: Causes, Consequences, and Policy Responses.” Policy research Note PRN/15/01, World Bank.

Baumeister C. and Kilian L. (2016). “Forty Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us”. *Journal of Economic Perspectives*, Vol. 30 (1), pp. 139-160.

Baumeister, C and G Peersman (2013), “The Role of Time-Varying Price Elasticities In Accounting For Volatility Changes In The Crude Oil Market”, *Journal of Applied Econometrics* 28(7), 1087-1109.

Blanchard, O J and J Gali (2009), “The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so different from the 1970s?”, in J Gali and M Gertler (eds), *International Dimensions of Monetary Policy*, Chicago, IL: University of Chicago Press, pp. 373-428.

Bentour E. M. 2020a. “Government Expenditure Multipliers Under Oil Price Swings,” AMF working paper series, pp. 1-39, UAE.

Bentour E. M. (2016). “On the Removal of Energy Products Subsidies in an Importing Oil Country: Impacts on Prices and Policy Implications in Morocco”. *Journal of Economic Cooperation and Development.* Vol. 37(2), SESRIC. http://www.sesric.org/jecd/jecd_articles/ART15101201-2.pdf

Bentour E.M. 2014. “Stock markets and economic growth in oil exporting countries: evidence from Kuwait”, *International Journal of Development and Sustainability*. Vol. 3(8), pp. 1806-1813. https://isdsnet.com/ijds-v3n8-14.pdf.

Bentour E. M. and Razzak W. A. (2010). "Real Interest Rates, Bubbles and Monetary Policy in the GCC countries." EERI WPS/2010/03, Economics and Econometrics Research Institute, Brussels.

Bower U., Winkler A. and Geis A. (2007). "Commodity price fluctuations and their impact on monetary and fiscal policies in Western and Central Africa." ECB Occasional Paper Series N. 60.

Cashin, P, K Mohaddes, M Raissi and M Raissi (2014), “The differential effects of oil demand and supply shocks on the global economy”, *Energy Economics* 44, 113-134.

Ciccarelli M. and Rebucci A. (2003). “Bayesian VARs: A Survey of the Recent Literature with an Application to the European Monetary System.” IMF Working Paper No. 03-102.

Doan, T., R. Litterman and C. Sims (1984), “Forecasting and Conditional Projection Using Realistic Prior Distributions”, *Econometric Reviews*, Vol. 3, No. 1, pp. 1-100.

Del Negro M. (2011) “Bayesian Macroeconometrics”. Edited by John Geweke, Gary Koop, and Herman Van Dijk, in The *Oxford Handbook of Bayesian Econometrics*. OUP, Oxford.

Deloitte Monitor (2020). “Impact of the oil industry crisis on the GCC and potential responses”.

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

Filardo A., Lombardi J. and Montoro C. (2018). "Monetary policy spillovers, global commodity prices and cooperation," BIS Working Papers 696, Bank for International Settlements.

Foroni C. and Stracca L. (2019). “Much Ado About Nothing? The Shale Oil Revolution and the Global Supply Curve.” European Central Bank Working Paper No. 2309.

Fueki T., Higashi H., Higashio N., Nakajima J., Ohyama S. and Tamanyu Y. (2020). "Identifying oil price shocks and their consequences: the role of expectations in the crude oil market." *International Finance*, https://onlinelibrary.wiley.com/doi/abs/10.1111/infi.12384

Geweke J., Koop G. and Van Dijk H. (2011). "*The Oxford Handbook of Bayesian Econometrics*". Oxford University Press, Oxford.

Giannone D., Lenza M. and Primiceri G. (2012). "Prior Selection for Vector Autoregressions." *Review of Economics and Statistics*. Vol. 97.

Hesse H. and Poghosyan T. (2009). "Oil Prices and Bank Profitability; Evidence From Major Oil-Exporting Countries in the Middle East and North Africa," IMF Working Paper 2009/220, IMF.

Kadiyala, K. R., and S. Karlsson (1997): "Numerical Methods for Estimation and Inference in Bayesian VAR-Models," *Journal of Applied Econometrics*, 12(2), 99–132.

Kang W., Ratti R. and Yoon K. (2014). "The Impact of Oil Price Shocks on the Stock Market Return and Volatility Relationship." *Journal of International Financial Markets, Institutions and Money*. Vol. 34, pp. 41-54, https://doi.org/10.1016/j.intfin.2014.11.002.

Kilian L. (2009). "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market." *American Economic Review*. Vol. 99(3), pp. 1053-69.

Koop, G., and D. Korobilis (2010): "Bayesian Multivariate Time Series Methods for Empirical Macroeconomics," *Foundations and Trends in Econometrics*, 3(4), 267– 358.

Litterman, R. (1980). "A Bayesian Procedure for Forecasting with Vector Autoregression". Working paper, Massachusetts Institute of Technology, Department of Economics.

Litterman, R. (1986) "Forecasting with Bayesian Vector Autoregressions – Five Years of Experience*," Journal of Business and Economic Statistics*, 4, 25–38.

Maugeri L. (2012). "Oil: The Next Revolution: The Unprecedented Upsurge of Oil Production Capacity and What It Means for the World." Belfer Center for Science and International Affairs, Harvard University.

Menichetti E., El Gharras A, Duhamel B. and Karbuz S. (2018). "The MENA Region in the Global Energy Markets." MENARA Working Papers No. 21, October 2018.

Peersman, G and I Van Robays (2012), "Cross-country differences in the effects of oil shocks", *Energy Economics* 34(5), 1532-1547.

Salisu A. and Gupta R. (2021). "Oil shocks and stock market volatility of the BRICS: A GARCH-MIDAS approach*." Global Finance Journal*. Vol. 48, https://doi.org/10.1016/j.gfj.2020.100546.

Sims, C. A. and T. Zha (1998): "Bayesian Methods for Dynamic Multivariate Models," *International Economic Review*, vol. 39, pp. 949–68.

Sims C. (1986). "Are Forecasting Models Usable for Policy Analysis?". *Federal Reserve Bank of Minneapolis, Quarterly Review* (Winter), pp. 2-16.

Tatum J. A. (1987). "The Macroeconomic Effects of the Recent Fall in Oil Prices." *Federal Reserve Bank of St. Louis.*

The Guardian, April 12, 2020. “Major oil-producing nations agree historic 10% cut in output” Jillian Ambrose. Accessible at : https://www.theguardian.com/business/2020/apr/12/major-oil-producing-nations-agree-historic-10-cut-in-output.

Van de Ven D. J. and Fouquet R. (2017). “Historical energy price shocks and their changing effects on the economy.” *Energy Economics*, Vol. 62, pp. 204-216, https://doi.org/10.1016/j.eneco.2016.12.009.

Wadhwani S. (2008). “should monetary policy respond to asset price bubbles? Revisiting the debate.” *National Institute Economic Review*, N. 206.

Wheeler C., Baffes J., Kabundi A., Kindberg-Hanlon G., Nagle P. and Ohnsorge, F. L. (2020). "Adding Fuel to the Fire: Cheap Oil during the COVID-19 Pandemic," Policy Research Working Paper Series 9320, The World Bank.

World Bank. (2020). “Trading together: Reviving Middle East and North Africa Regional Integration in the Post-Covid Era”. MENA Economic Update, October 2020.

Table 1. Impacts of a negative oil price shock on the real demand components

	Years following the shock	Gross Domestic Product (GDP)	Domestic demand				Foreign demand
			Final Consumption (FC)	Government Consumption (GC)	Gross Capital Formation (GCF)	Imports (IM)	Non-oil Exports (EX)
ALGERIA	First year	0.0028	-0.0056	-0.0111	-0.0195	-0.0300	0.0191
	Second year	-0.0045	-0.0071	-0.0047	-0.0080	-0.0155	-0.0037
BAHRAIN	First year	-0.0037	-0.0136	-0.0109	-0.0615	-0.0113	0.0029
	Second year	-0.0035	-0.0088	-0.0071	-0.0243	-0.0075	0.0003
IRAQ	First year	-0.0037	0.0016	-0.0068	-0.0407	-0.0094	0.0039
	Second year	-0.0022	-0.0021	-0.0099	-0.0067	-0.0029	-0.0006
KUWAIT	First year	-0.0145	-0.0213	-0.0189	-0.0398	-0.0278	0.0027
	Second year	-0.0099	-0.0090	-0.0061	-0.0079	-0.0081	-0.0073
LIBYA	First year	-0.0456	-0.0148	-0.0272	-0.0509	-0.0491	-0.0532
	Second year	0.0140	-0.0112	-0.0158	0.0077	-0.0074	0.0272
OMAN	First year	-0.0299	-0.0332	-0.0213	-0.0368	-0.0389	-0.0215
	Second year	-0.0103	-0.0084	-0.0091	-0.0235	-0.0099	-0.0064
QATAR	First year	-0.0055	-0.0080	-0.0350	-0.0464	-0.0300	-0.0052
	Second year	-0.0056	-0.0051	0.0005	-0.0150	-0.0029	-0.0012
SAUDIA	First year	-0.0168	-0.0201	-0.0305	0.0127	-0.0283	-0.0088
	Second year	-0.0025	-0.0045	-0.0062	-0.0155	-0.0105	-0.0038
UAE	First year	-0.0050	-0.0313	-0.0122	-0.0418	-0.0078	0.0065
	Second year	-0.0049	-0.0062	-0.0140	-0.0032	-0.0053	-0.0032

Table 2. Impacts of a negative oil price shock on the real sectors of: manufacturing industries, construction, and the major services components (supply side).

	Years following the shock	GDP	Manufacturing industries	Construction	Wholesale, retail, restaurants hotels	Transport, storage and communication	Other services
Algeria	First year	-0.0001	-0.0018	-0.0021	-0.0025	-0.0031	0.0010
	Second year	-0.0003	-0.0008	-0.0007	-0.0007	-0.0003	-0.0002
Bahrain	First year	0.0010	-0.0017	0.0034	0.0012	-0.0004	-0.0006
	Second year	0.0001	0.0001	-0.0002	0.0000	0.0000	-0.0002
Iraq	First year	-0.0032	0.0003	-0.0144	-0.0027	-0.0018	-0.0019
	Second year	0.0001	-0.0002	-0.0026	0.0000	-0.0008	-0.0008
Kuwait	First year	-0.0034	0.0000	-0.0013	-0.0134	-0.0008	-0.0028
	Second year	-0.0013	-0.0013	-0.0016	-0.0016	-0.0022	-0.0006
Libya	First year	-0.0075	0.0063	-0.0017	-0.0044	-0.0050	-0.0055
	Second year	-0.0012	-0.0024	-0.0024	-0.0021	-0.0021	-0.0018
Oman	First year	-0.0093	-0.0160	-0.0255	-0.0134	-0.0148	-0.0092
	Second year	-0.0022	-0.0014	-0.0088	-0.0020	-0.0023	-0.0018
Qatar	First year	-0.0029	0.0057	-0.0015	-0.0039	0.0003	-0.0068
	Second year	-0.0007	-0.0007	-0.0014	-0.0011	-0.0012	-0.0008
KSA	First year	-0.0055	-0.0005	-0.0040	-0.0035	-0.0012	-0.0026
	Second year	-0.0005	0.0001	-0.0037	-0.0024	-0.0010	-0.0017
UAE	First year	-0.0034	0.0010	-0.0023	-0.0004	-0.0006	-0.0027
	Second year	-0.0006	-0.0016	-0.0008	-0.0004	-0.0004	-0.0007

Note: we used the Litterman/Minnesota method with hyperparameters $(\mu, \lambda_1, \lambda_2, \lambda_3)$*= (0,0.1;0.9;1) (see section 3)*
Source: Estimated by the author using a BVAR demand model with a shock of a negative innovation of -30%.

9. Appendix 1. Augmented Dickey-Fuller test statistics

	GDP		Dlog(GDP)		EX		Dlog(EX)		IM		Dlog(IM)		FC		Dlog(FC)	
	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
Algeria	0.6522	0.9897	-8.2039	**0.0000**	-1.4219	0.5633	-2.8382	**0.0612**	-0.9005	0.7791	-2.8288	**0.0625**	-0.0968	0.9435	-1.8847	**0.0574**
Bahrain	1.7555	0.9996	-6.4655	**0.0000**	0.5268	0.9859	-3.7326	**0.0068**	0.5343	0.9861	-3.5759	**0.0103**	0.9038	0.9947	-3.4342	**0.0149**
Iraq	2.4875	1.0000	-11.5560	**0.0000**	6.0537	1.0000	-4.7132	**0.0004**	3.4700	1.0000	-3.9724	**0.0035**	1.2421	0.9980	-2.6143	**0.0978**
Kuwait	0.7550	0.9921	-4.2451	**0.0015**	-0.5970	0.8610	-3.6094	**0.0095**	-0.7114	0.8335	-3.5530	**0.0007**	0.3320	0.9775	-3.0445	**0.0031**
Libya	-2.6441	0.0919	-7.3176	**0.0000**	-2.2331	0.1979	-3.7853	**0.0059**	-2.0953	0.2475	-3.9828	**0.0034**	-2.3227	0.1695	-4.1974	**0.0019**
Oman	0.8761	0.9943	-5.0044	**0.0001**	1.1123	0.9970	-3.0678	**0.0365**	0.6709	0.9902	-3.5632	**0.0107**	-1.4966	0.5262	-3.0259	**0.0402**
Qatar	-0.7038	0.8354	-2.6851	**0.0843**	0.9547	0.9954	-3.0460	**0.0384**	0.9601	0.9955	-2.7467	**0.0744**	-2.3141	0.1721	-2.9744	**0.0038**
KSA	0.3449	0.9782	-5.3005	**0.0001**	-1.0901	0.7117	-3.3156	**0.0201**	-0.5456	0.8722	-2.8775	**0.0561**	0.1494	0.9661	-3.7477	**0.0065**
UAE	1.0815	0.9968	-5.0866	**0.0001**	1.2739	0.9982	-3.5312	**0.0116**	0.3587	0.9789	-3.8759	**0.0002**	-0.6376	0.8517	-4.2830	**0.0001**

	GC		Dlog(GC)		GCF		Dlog(GCF)		MAN		Dlog(MAN)		CON		Dlog(CON)	
	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
Algeria	0.5127	0.9854	-2.6481	**0.0092**	0.1722	0.9677	-2.6054	**0.0995**	-0.3249	0.9129	-3.9163	**0.0039**	1.1897	0.9976	-1.9623	**0.0485**
Bahrain	0.1884	0.9689	-2.0945	**0.0360**	0.7632	0.9923	-3.1158	**0.0326**	1.1600	0.9974	-8.6564	**0.0000**	0.1896	0.9690	-5.1632	**0.0001**
Iraq	1.0633	0.9966	-4.4689	**0.0008**	1.7198	0.9995	-4.5663	**0.0006**	4.9056	1.0000	-7.7621	**0.0000**	1.6673	0.9995	-5.1630	**0.0001**
Kuwait	-0.4426	0.8927	-3.8028	**0.0056**	-0.3734	0.9049	-3.4365	**0.0148**	-0.2899	0.9182	-7.9302	**0.0000**	-0.7550	0.8219	-4.5414	**0.0006**
Libya	-1.2360	0.1958	-4.3955	**0.0010**	-2.1083	0.2425	-3.1914	**0.0272**	-1.9148	0.3228	-5.5016	**0.0000**	-2.2436	0.1944	-5.7320	**0.0000**
Oman	0.5269	0.9859	-2.6345	**0.0939**	1.0340	0.9963	-4.3313	**0.0013**	1.6394	0.9994	-4.9923	**0.0002**	-0.2715	0.9210	-4.6103	**0.0005**
Qatar	-1.9862	0.2917	-3.3360	**0.0013**	1.6037	0.9993	-3.1074	**0.0332**	1.2371	0.9979	-7.8055	**0.0000**	2.5691	1.0000	-5.2585	**0.0001**
KSA	-0.5894	0.8627	-3.0761	**0.0358**	-0.3542	0.9075	-3.0947	**0.0350**	1.6286	0.9994	-7.3350	**0.0000**	-1.2831	0.6294	-3.6594	**0.0081**
UAE	2.3508	0.9999	-4.9850	**0.0000**	0.2159	0.9707	-3.0607	**0.0371**	0.8027	0.9930	-5.8605	**0.0000**	-0.4444	0.8923	-3.8057	**0.0054**

	SRRH		Dlog(SRRH)		TRSC		Dlog(TRSC)		OTSER		Dlog(OTSER)		Oil price		Dlog(Oil price)	
	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
Algeria	0.0735	0.9601	-3.4906	**0.0127**	1.7079	0.9995	-3.2866	**0.0213**	1.9633	0.9998	-5.2500	**0.0001**	-2.232245	0.1980	-6.472321	**0.0000**
Bahrain	0.4994	0.9849	-6.2570	**0.0000**	1.2278	0.9979	-7.9432	**0.0000**	1.1272	0.9972	-5.6118	**0.0000**				
Iraq	3.6451	1.0000	-9.5445	**0.0000**	0.9248	0.9950	-4.6744	**0.0004**	1.5540	0.9992	-5.6928	**0.0000**				
Kuwait	-0.5742	0.8661	-6.2301	**0.0000**	0.6433	0.9894	-5.5182	**0.0000**	0.3530	0.9786	-5.8231	**0.0000**				
Libya	-2.8062	0.0654	-4.6877	**0.0004**	-2.5792	0.1047	-4.4644	**0.0008**	-1.9396	0.3119	-3.3461	**0.0182**				
Oman	2.2692	0.9999	-5.5505	**0.0000**	0.1744	0.9679	-6.0274	**0.0000**	1.9664	0.9998	-5.3412	**0.0001**				
Qatar	0.1595	0.9668	-6.5700	**0.0000**	-0.6288	0.8537	-3.7834	**0.0057**	-1.4489	0.5500	-5.6348	**0.0000**				
KSA	-1.0371	0.7319	-1.8292	**0.0645**	-0.8729	0.7878	-4.2161	**0.0017**	0.6859	0.9905	-3.1791	**0.0276**				
UAE	0.8104	0.9932	-6.1903	**0.0000**	0.4638	0.9835	-6.1237	**0.0000**	2.2120	0.9999	-5.9529	**0.0000**				

The ADF t-Statistics obtained should be compared to critical values as references for a test including a constant term are displayed as:

at	1% level	equal	-3.58
at	5% level	equal	-2.93
at	10%level	equal	-2.60

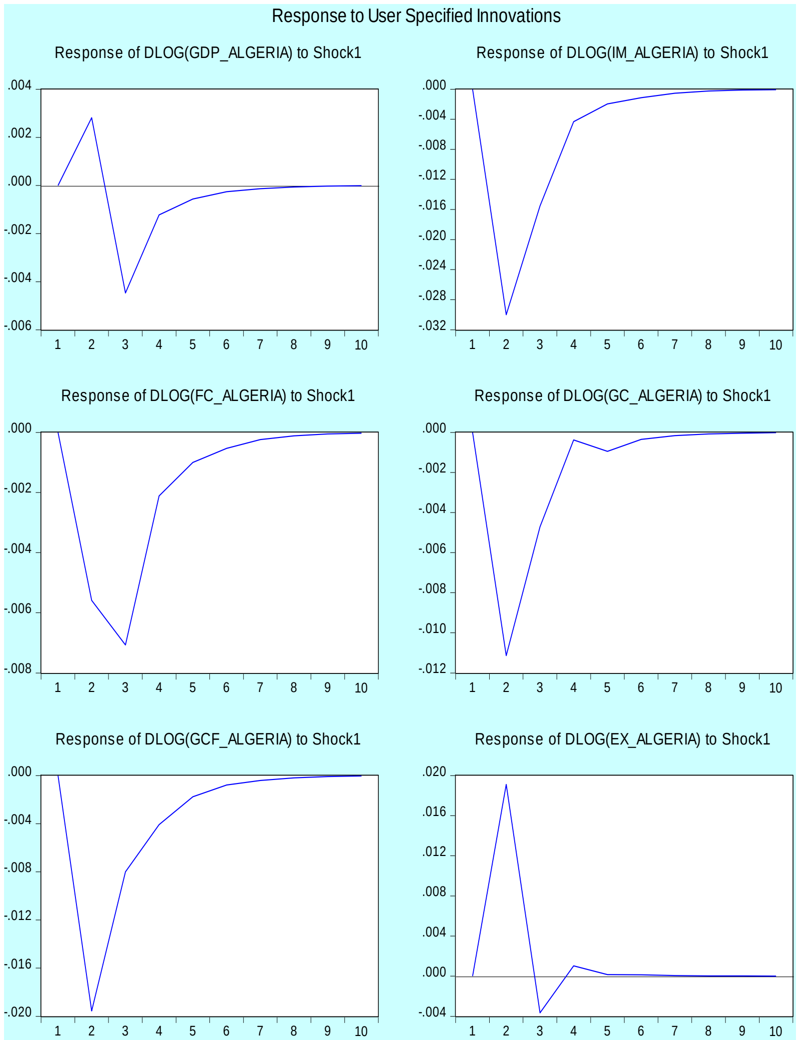
* MacKinnon (1996) one-sided p-values.

Notes: Dlog(X) stands for first differences of the natural logarithm for the variable X representing respectively the Gross Domestic Product (GDP), exports of goods and services (EX), imports of goods and services (IM), final consumption (FC), government consumption (GC), gross capital formation (GCF), manufacturing industries (MAN), construction (CON), sales, retail, restaurants and hotels services (SRRH), transport, storage and communications (TRSC) and other services (OTSER).

10. Appendix 2: Oil price shocks figures

Figure 2. Algeria

Negative oil price shock on the demand components



Negative oil price shock on the supply components

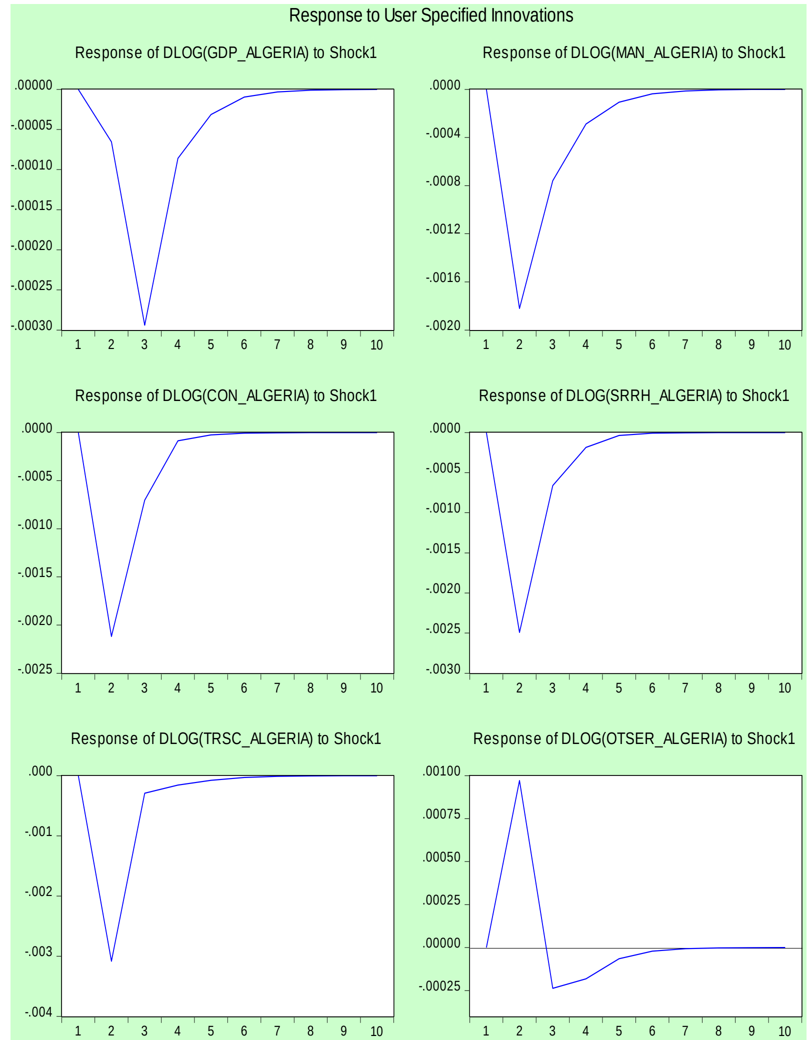
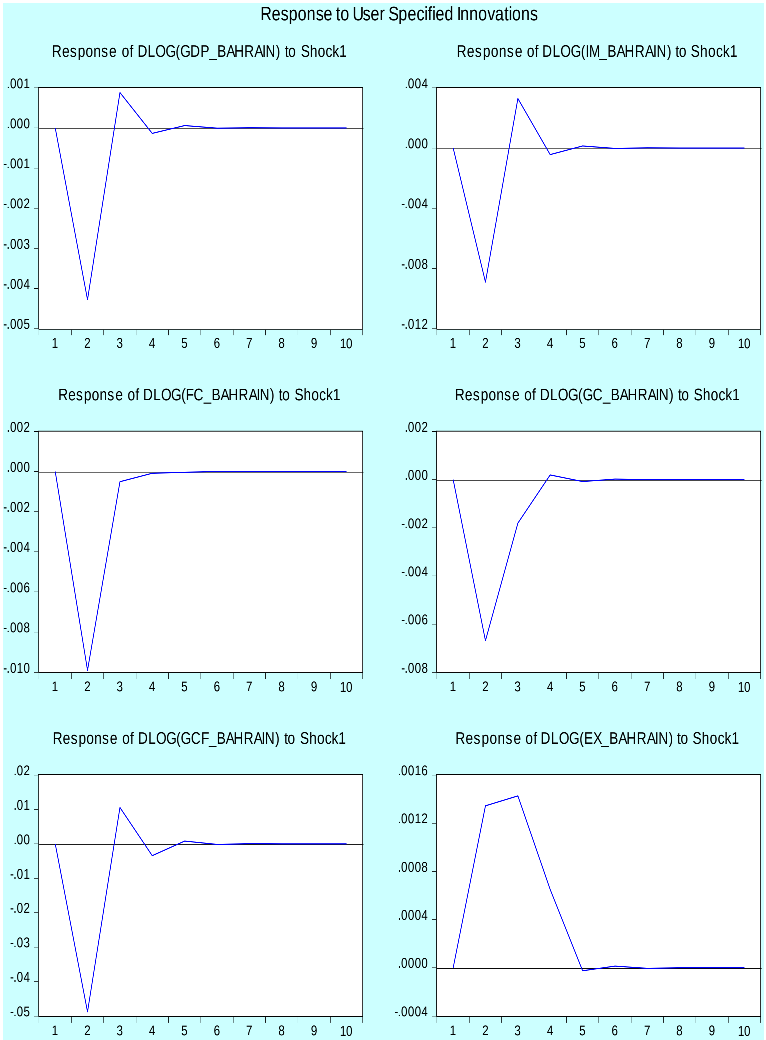


Figure 3. Bahrain

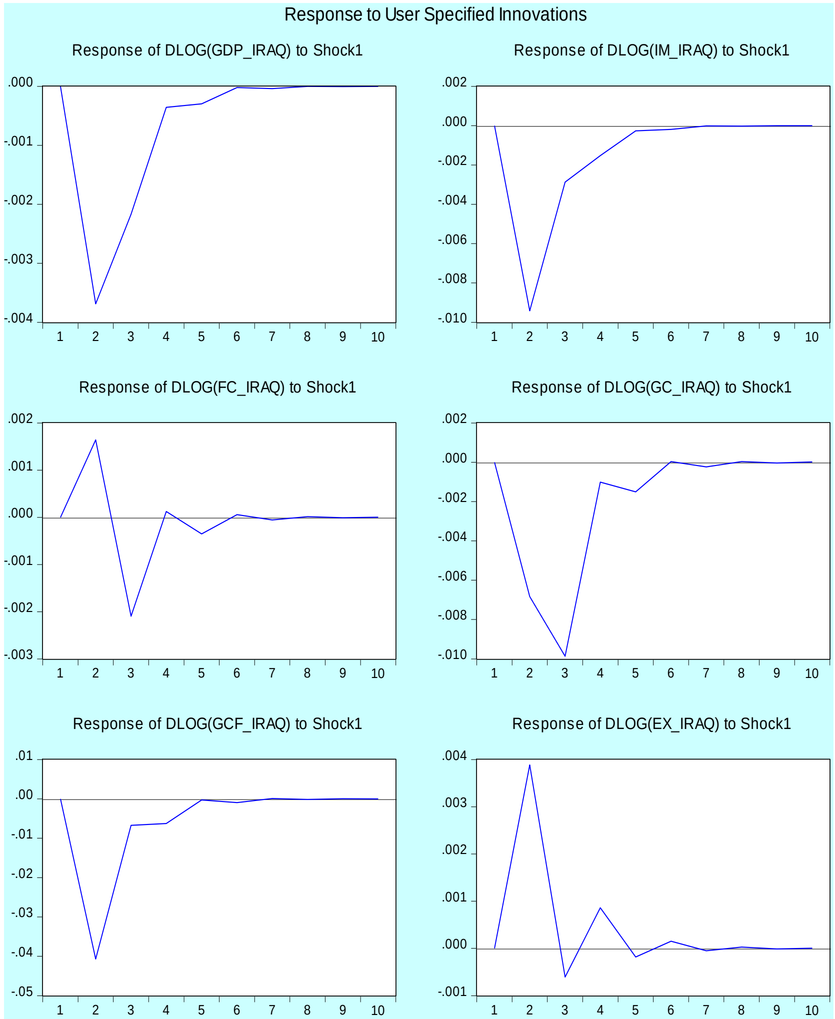
Negative oil price shock on the demand components



Negative oil price shock on the supply components

Figure 4. Iraq

Negative oil price shock on the demand components



Negative oil price shock on the supply components

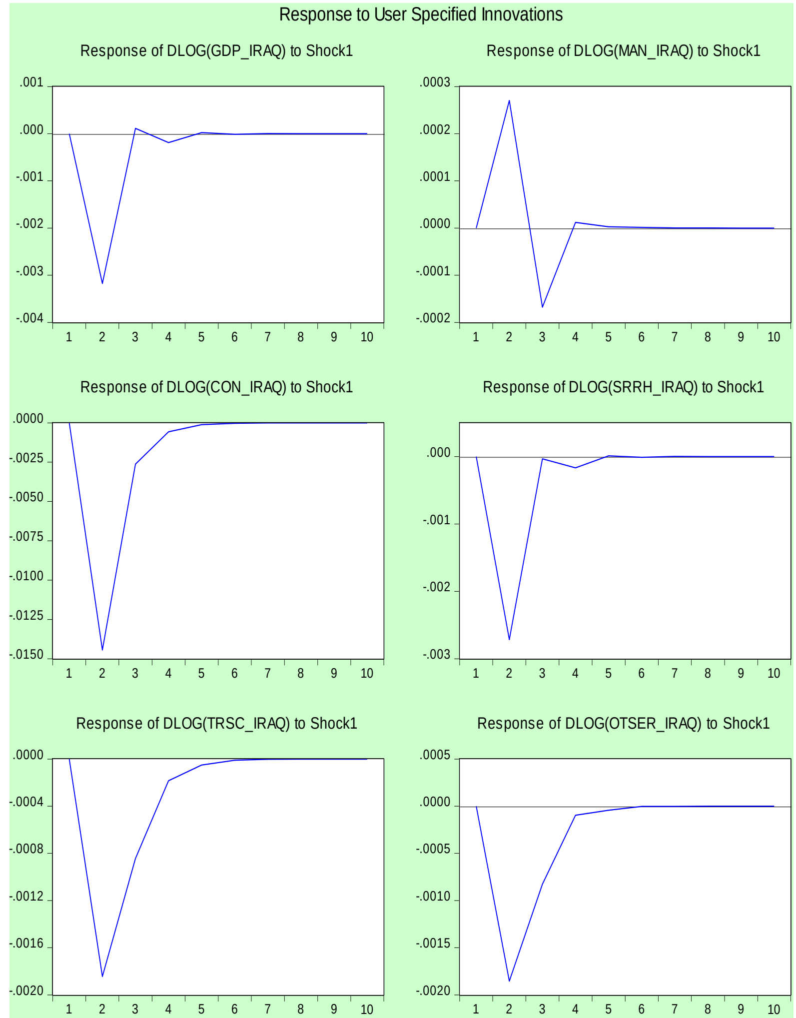
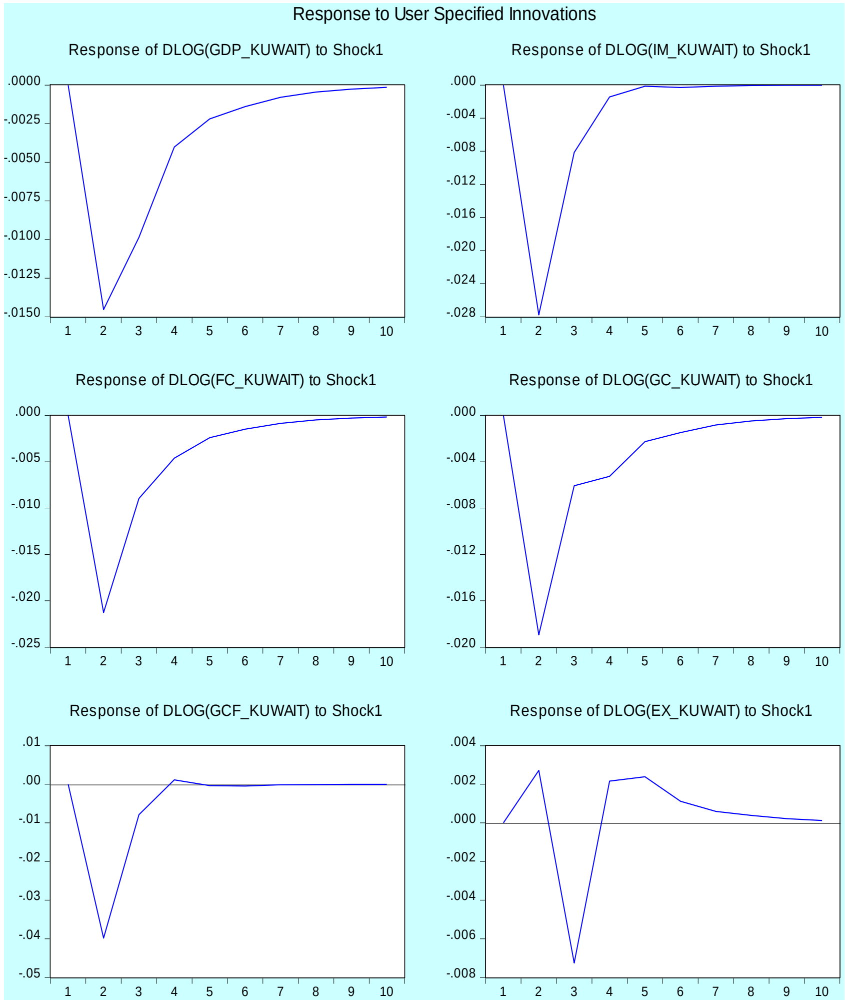


Figure 5. Kuwait

Negative oil price shock on the demand components



Negative oil price shock on the supply components

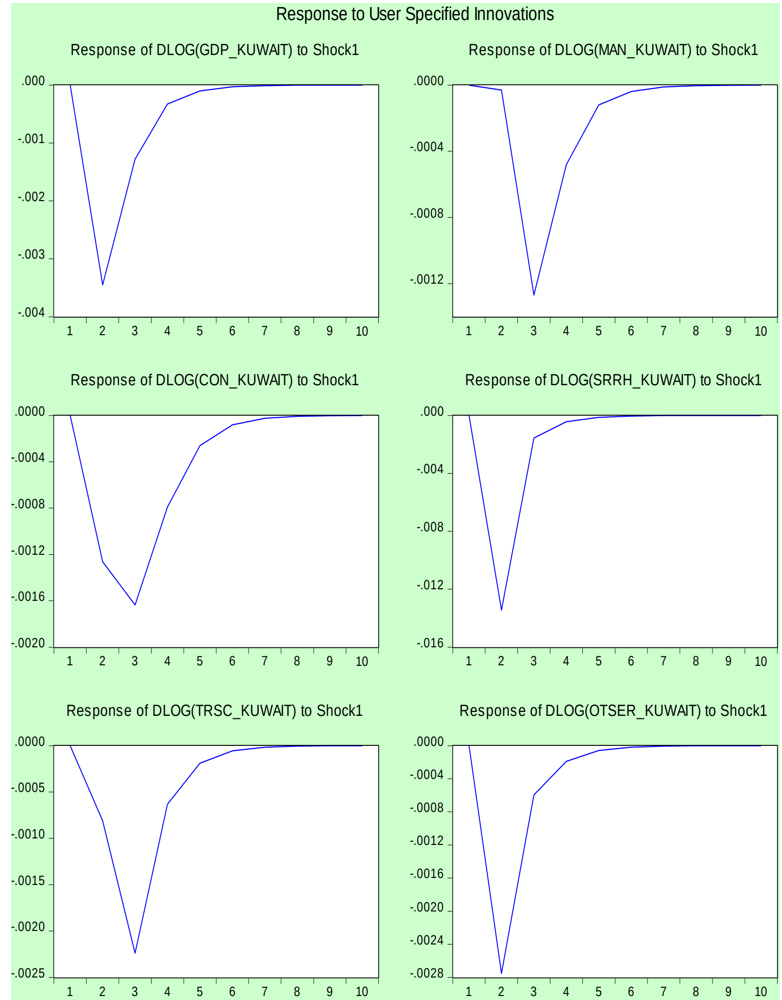
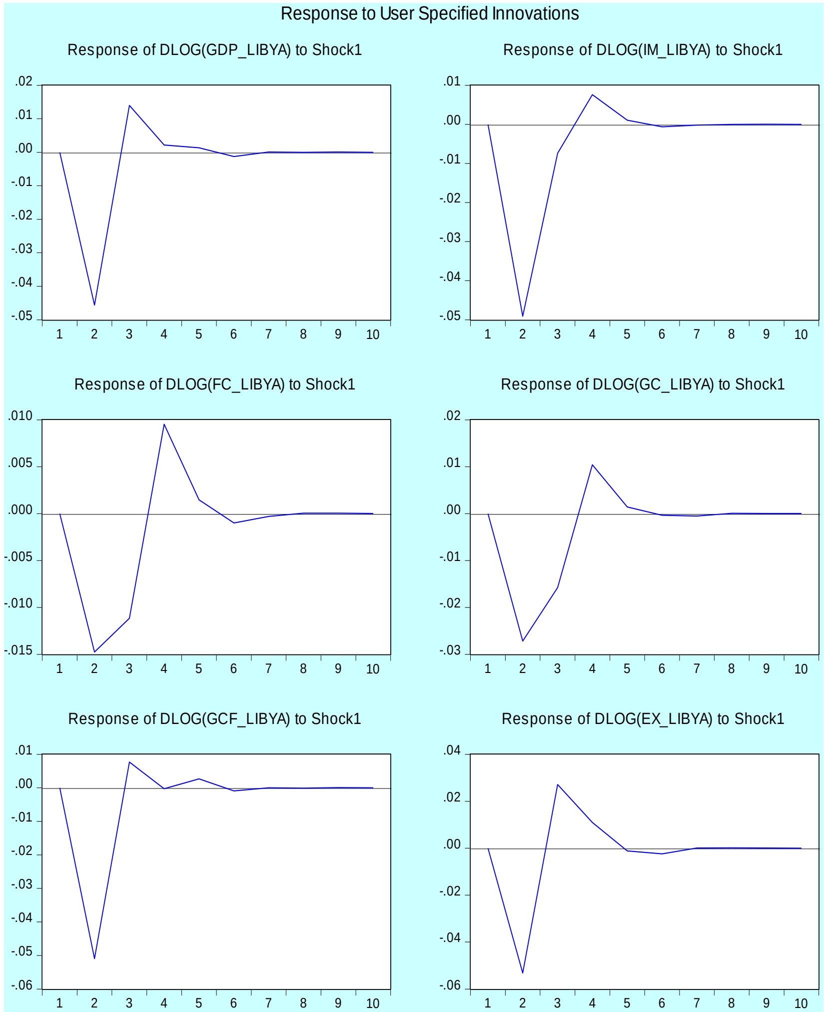


Figure 6. Libya

Negative oil price shock on the demand components



Negative oil price shock on the supply components

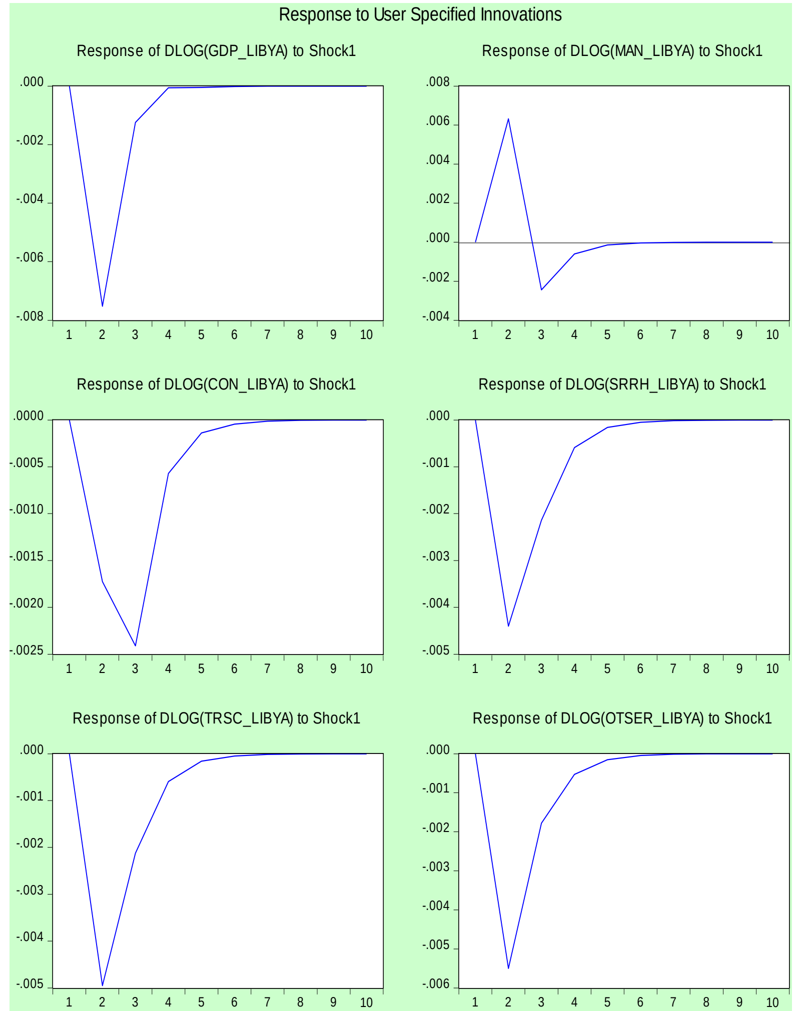
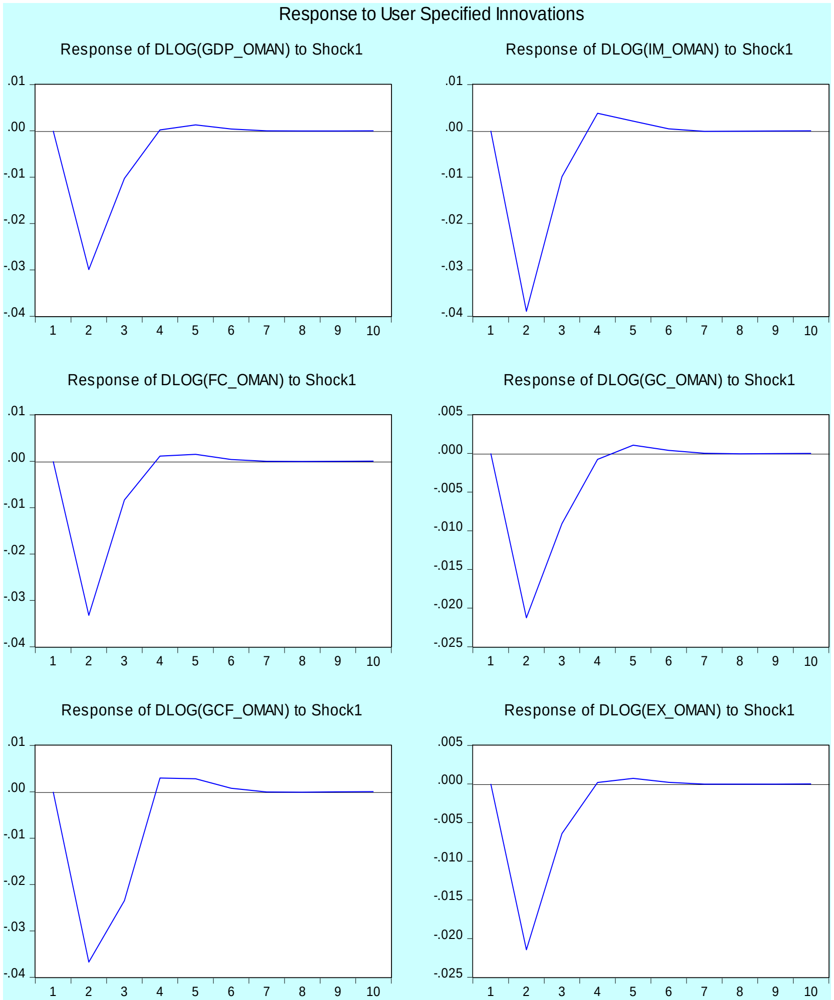


Figure 7. Oman

Negative oil price shock on the demand components



Negative oil price shock on the supply components

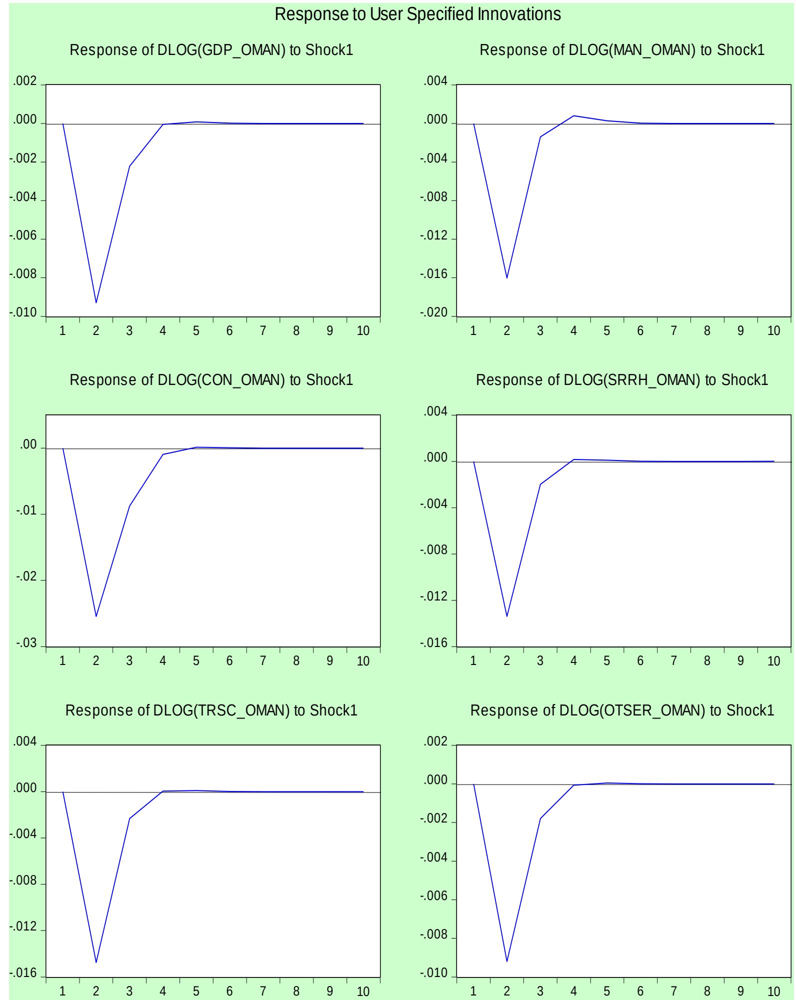
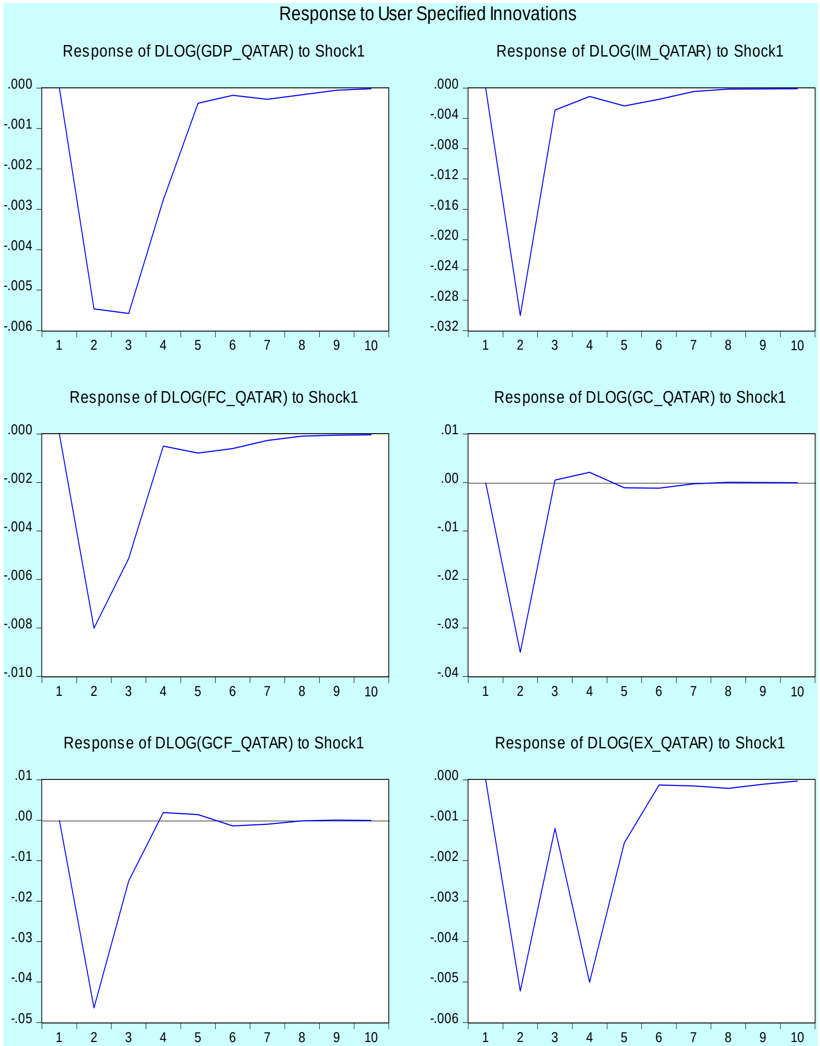


Figure 8. Qatar

Negative oil price shock on the demand components



Negative oil price shock on the supply components

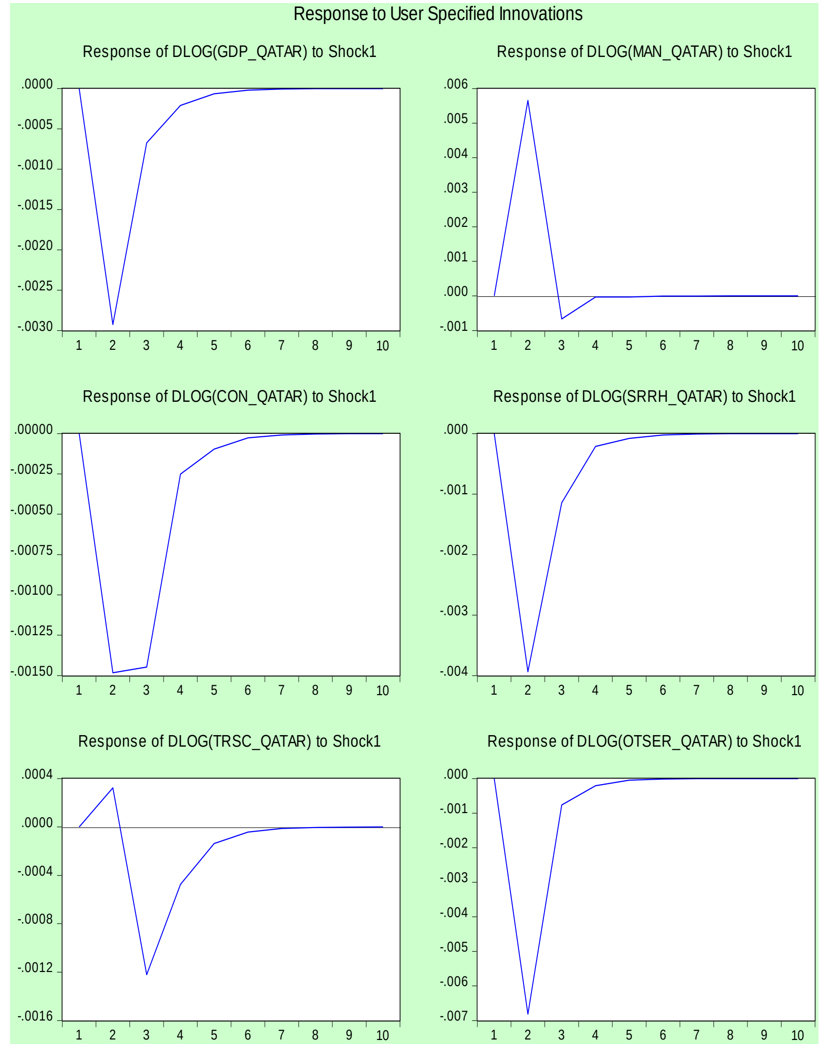
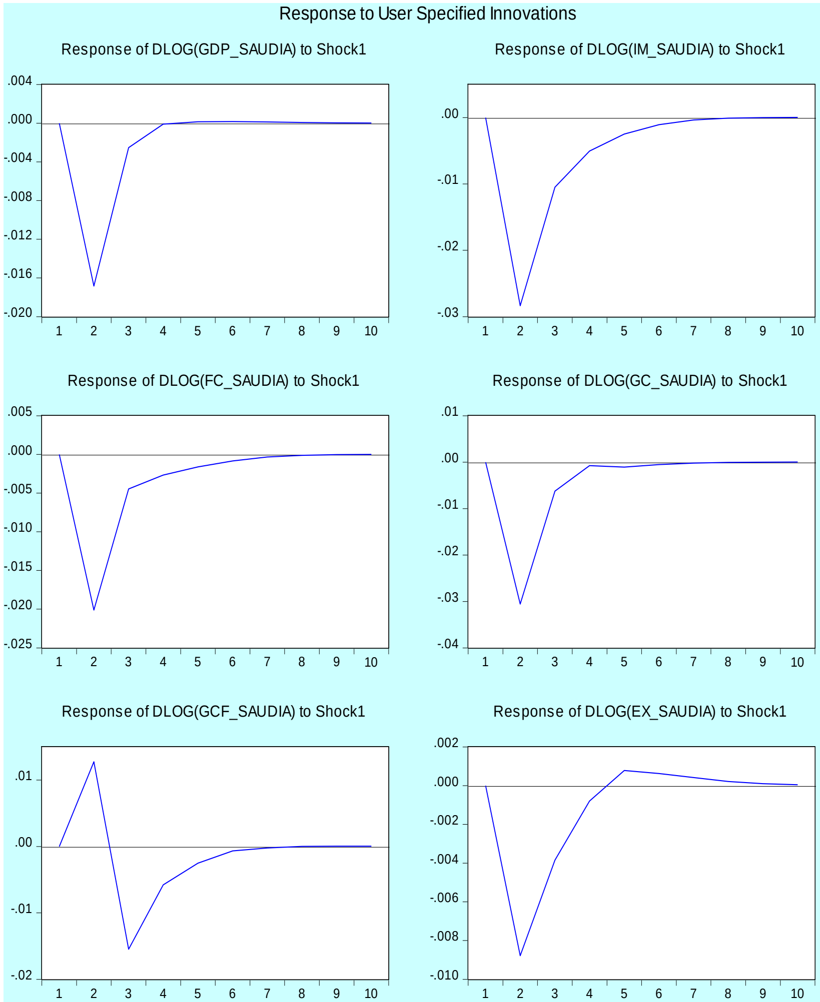


Figure 9. Saudi Arabia

Negative oil price shock on the demand components



Negative oil price shock on the supply components

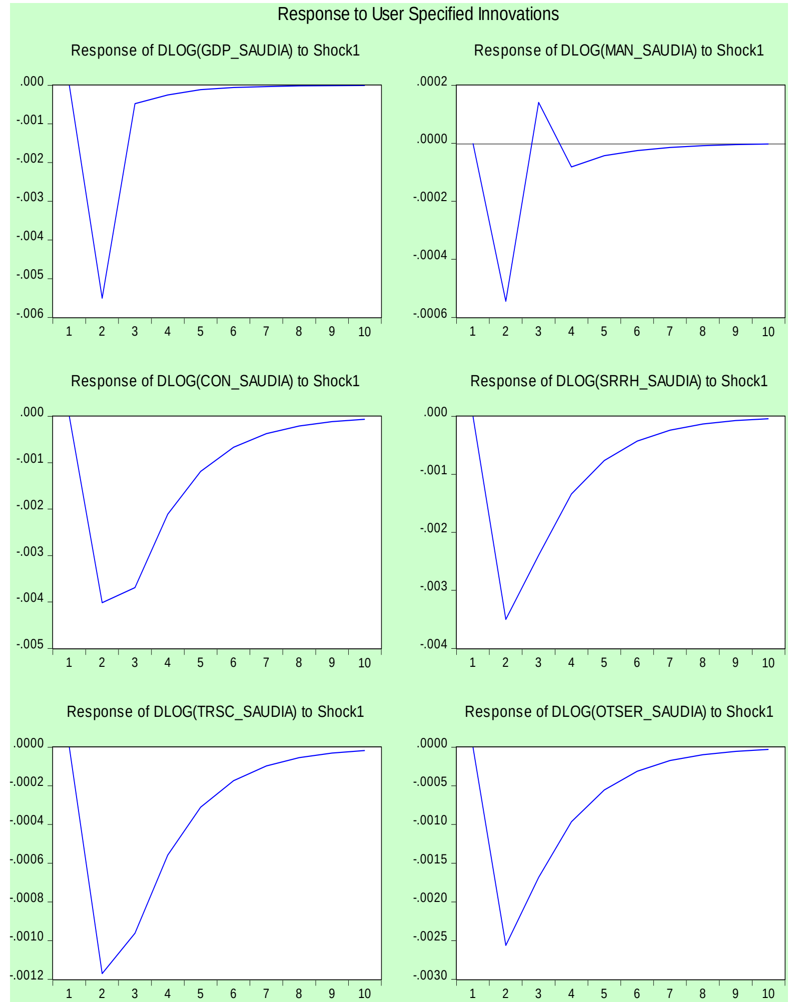
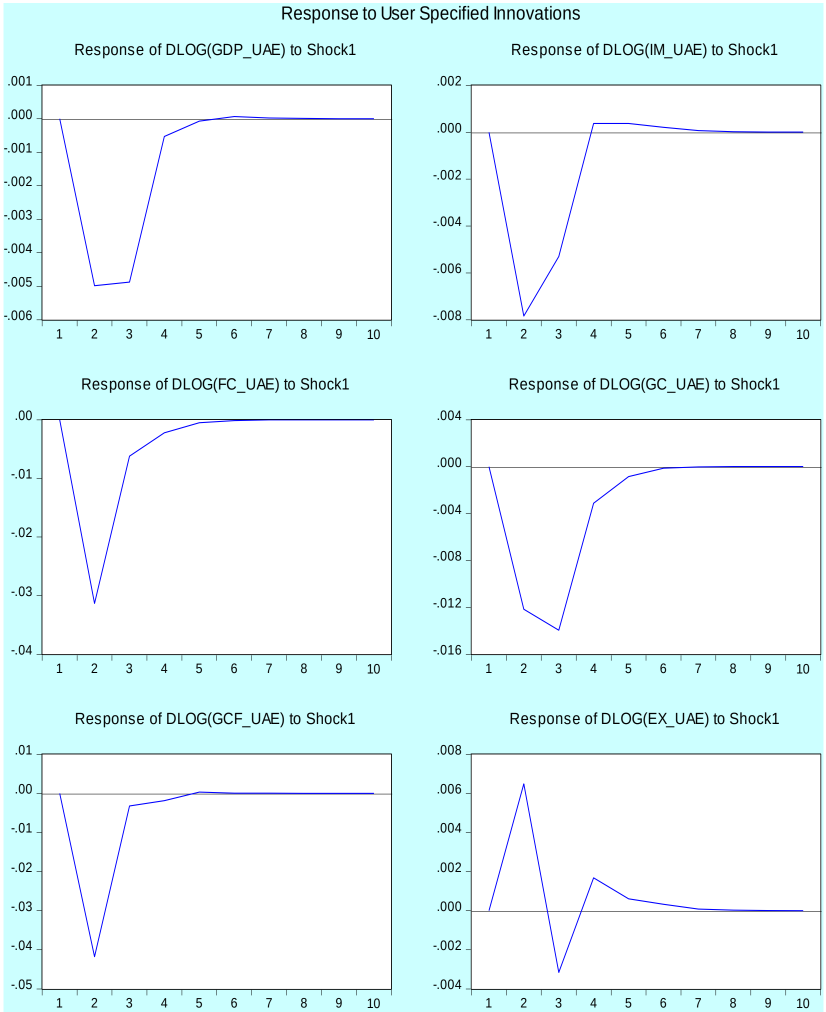


Figure 10. United Arab Emirates

Negative oil price shock on the demand components



Negative oil price shock on the supply components