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Business Cycles in Oil Exporting Countries: A Declining Role for Oil?

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Abstract

In this study, we investigate the nature and possible sources of economic fluctuations in oil exporting countries using principle component and impulse-response analysis. The principal component analysis shows that the first two components can be statistically significantly explained by world GDP, but not by oil prices. We further develop our study using impulse-response analysis and find that a global demand shock is as important as oil supply and oil demand shocks in determining the dynamics of macroeconomic variables of interest. Though previous studies in this field underline the importance of institutional factors, we find that rising global political and economic integration can play a critical role in explaining business cycles of these economies. With increasing integration into the world economic system, oil exporting countries have become more susceptible to world business cycles, the sources of economic fluctuations have become more diversified, and consequently, the role of oil has declined over time. These results have crucial policy implications for the role of the fiscal and monetary policy in managing economic fluctuations in these economies.

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ABSTRACT

In this study, we investigate the nature and possible sources of economic fluctuations in oil exporting countries using principle component and impulse-response analysis. The principal component analysis shows that the first two components can be statistically significantly explained by world GDP, but not by oil prices. We further develop our study using impulse-response analysis and find that a global demand shock is as important as oil supply and oil demand shocks in determining the dynamics of macroeconomic variables of interest. Though previous studies in this field underline the importance of institutional factors, we find that rising global political and economic integration can play a critical role in explaining business cycles of these economies. With increasing integration into the world economic system, oil exporting countries have become more susceptible to world business cycles, the sources of economic fluctuations have become more diversified, and consequently, the role of oil has declined over time. These results have crucial policy implications for the role of the fiscal and monetary policy in managing economic fluctuations in these economies.

JEL classification: C11, C32, E30, E32

Keywords: Business Cycles; Oil Exporting Countries; Oil price; Bayesian methods

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I. Introduction

Most studies on oil exporting countries find that terms-of-trade shocks have significant effects on the economies of these countries (see, among others, Amano and Norden (1995), Hansen and Hutchison (1997), Spatafora and Warner (1999), Kireyev (2000), Cashin, Cespedes, and Sahay (2003), Rautava (2004), etc.). Because of their commodity exporting nature and higher susceptibility to terms-of-trade shocks, some researchers treat these economies as if they are demonstrating similar dynamics (see, for example, Buiter (2008), Husain, Tazhibayeva and Ter-Martirosyan (2008), Rafiq (2011)).

There is also empirical evidence that business cycles of oil exporting countries demonstrate different regularities than industrialized countries. This is not a surprising finding if we consider the fact that a rise in oil prices has adverse effects across country groups. An oil shock, which is the most frequent shock hitting oil exporters, is a positive shock boosting economic activity in the case of oil exporters, but a negative shock depressing income for oil importers. In addition, as majority of oil exporters are pursuing pegged exchange regimes, in the face of oil shocks, most of the adjustment in the economy is realized through corrections in prices, inducing higher volatility in output and in economy.

In this paper, we investigate whether oil exporting countries are all alike or whether economic fluctuations and the response dynamics of macroeconomic variables are similar. Besides we also test for the possible sources of economic fluctuations and whether the oil is the main culprit behind business cycles in oil exporting countries.

To investigate this question, we use principal component analysis and identify four principal components that explain more than half of the variations in these economies. We also calculate correlations between the extracted principal components, world GDP and real oil prices. In addition, we conduct a regression analysis with the same variables and test the significance of each variable in the regression. We find that the first two components which are responsible for much of the fluctuations in the data can be statistically significantly explained by real world GDP, but not the real oil price. In contrast, the third and the fourth components are well explained by the real oil price whereas world GDP appears to be an insignificant factor after controlling for the real oil price. Because the first two components account for higher variations in the data, this shows that real world GDP is a much stronger candidate than the oil price to explain economic fluctuations in these countries.

Second, we apply the methodology proposed by Giannone, Lenza and Primiceri (2012) and identify four shocks (applying a slightly modified version of Kilian (2009)) as the main candidates to explain the sources of economic fluctuations in oil exporting countries. The impulse-responses from this analysis reveal that a global demand shock is as important as oil supply and oil demand shocks in determining the dynamics of macroeconomic variables of interest. In other words, global fluctuations are at least as important as oil factor in determining

the macroeconomic fluctuations in the oil exporting countries. This finding is in line with the results of the PC analysis and support the relatively strong importance of world business cycles for oil exporting countries.

We begin our analysis by documenting business cycle facts in oil exporting countries. Following the business cycle literature, we use the Hodrick-Prescott filter to de-trend data. Then we calculate their second moments and compare these with the respective indicators in the literature. We believe that documenting these facts is important to gain insights about the nature of the economic fluctuations in these countries and helps us to improve theoretical models that aim to capture essential dynamics of these economies by providing guidance on possible model specification and underlying frictions. We view this approach as complementing the recent advances in business cycle accounting introduced by Chari, Kehoe and McGrattan (2007).

This paper aims to serve several purposes. First, we document the business cycle regularities and stylized facts in oil exporting countries using the most recent data available. Second, we investigate the possible sources of economic fluctuations in the oil exporting countries and try to find a common oil country factor using principle component analysis. Third, we also examine the response dynamics of the main macroeconomic variables to different shocks in these countries.

The structure of the paper is as follows: II section provides a brief literature review, III section discusses data, IV section introduces the empirical methodology and identification scheme used in the paper, V section presents the main empirical findings under three subsections, and VI section concludes.

II. Literature Review

There is a vast theoretical and empirical literature devoted to the study of macroeconomic fluctuations in advanced economies. One of the main reasons for this trend in academia and research institutes is the availability and quality of data in developed economies. However, over time with advances in data availability researchers have begun to test their models with data from developing and emerging market economies.“Are business cycles all alike?”or “Is there a world business cycle?” are more common and popular questions among business cycle researchers even today. Substantial research studies provided evidence on the similarities of business cycles in industrialized countries (see, for example, Backus, et al. (1995), Baxter (1995), Lumsdaine and Prasad (2003), etc.).

There is also an extensive literature on macroeconomic fluctuations in developing countries. For example, Agenor, et al (1999) reveals significant similarities between macroeconomic fluctuations in developing and industrial countries. In a more comprehensive study, Kose et al (2003) find evidence on a distinct world business cycle and a significant world component explaining fluctuations in a number of countries. However, some studies also emphasize

important differences among countries. For example, in a recent study, Benczur and Ratfai (2009) find evidence of substantial heterogeneity in business cycle patterns between developed and developing worlds. Altug and Bildirici (2010) document that business cycles of developed and emerging market economies exhibit considerable differences.

Business cycle analysis across country groups also reveals important regularities and interesting patterns. Benczur and Ratfai (2005) find that fluctuations in Central and Eastern Europe countries are larger than those in industrial countries, but overall cyclical patterns are homogenous and similar. The findings of Benczur, Muradov and Ratfai (2006) emphasize that economic fluctuations in CIS countries are more volatile and less persistent than elsewhere. Nevertheless, they also show that there are significant similarities in business cycles across those countries. Studying CIS and some selected developed countries, Mammadov (2007) finds that the standard business cycle model can be used to study macroeconomic fluctuations in CIS countries as well.

Investigating GCC economies, Rafiq (2011) shows that the terms-of-trade shocks explain significant but relatively smaller degree of output fluctuations. He also concludes that the business cycles of those oil exporting countries are not driven by output shocks of industrialized countries and do not demonstrate similar patterns. Using a structural VAR approach, Mehrara and Oskoui (2007) study the sources of macroeconomic fluctuations in oil-exporting countries. They find that oil price shocks are the main source of output fluctuations in Saudi Arabia and Iran, but not in Kuwait and Indonesia. In a more comprehensive recent study, Mehrara and Mohaghegh (2011) show that most oil producers in the sample isolate real sectors of their economies from the effects of oil price. Nevertheless, oil shocks still remain the main source of macroeconomic fluctuations in oil exporting countries. Korhonen and Mehrotra (2009) find that oil price shocks are an important source of output fluctuations in Russia and Venezuela. However, in Kazakhstan and Iran they do not appear to be as significant as perhaps they were previously thought. Using a large dataset on resource rich countries, Arezki et al. (2011) provided evidence that higher quality of political institutions dampens the negative effects of resource windfalls on macroeconomic stability and economic growth.

In the case of oil exporting countries, the analysis of the business cycle literature and empirical research provide heterogeneous results and equivocal evidence. For some oil exporting countries, the role of oil shocks in explaining economic fluctuations does not appear to be very important. In contrast, for others oil shocks constitute an important source of economic fluctuations and real exchange rate movements. As some studies show, the quality of institutions and impartial legal systems insulate oil rich economies from oil price volatility. Existing economic structure and organization of economic activity in oil exporting countries also determine the nature of macroeconomic fluctuations in those countries. Most of the time, fiscal expenditure is the most important channel that transmits oil price shocks to the rest of the economy (see, for example, Husain, Tazhibayeva and Ter-Martirosyan (2008), Devlin and Lewin (2004)). A more disciplined fiscal authority, transparent spending mechanism and strictly followed expenditure

rules can be considered of vital importance for smoothing fluctuations due to oil price shocks. In a theoretical setting, Huseynov and Ahmadov (2013) show that fiscal discipline is an important ingredient of fiscal policy aiming to smooth fluctuations in oil exporting countries.

III. Data

There are a lot of countries that can be considered as falling under the category of "oil exporting country". However, what we mean by an "oil exporting country" in this paper is one whose economic structure is mainly dominated by the oil sector and which is predominantly exporting oil products. Hence, one needs clear criteria to classify countries as oil exporting ones.

In this paper, we will consider a country an "oil exporting country" if it satisfies two criteria on average during the sample period: (i) rent from the oil sector constitutes more than 10% of its GDP (ii) it exports more than 500 thousand barrel per day. These two criteria will allow us to mainly focus on the oil exporting countries which have more or less a similar economic structure. There are sixteen countries that meet these criteria. We will drop three of them, namely, Iraq, Libya and Qatar, from our list because of data availability. The remaining countries are Algeria, Angola, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Norway, Oman, Russia, Saudi Arabia, United Arab Emirates and Venezuela.

The sample period covers 1995-2012 years. It is difficult to go further in the past as some countries faced political reorganization in recent times (Azerbaijan, Kazakhstan and Russia) and they do not have reliable data before that period. The quality of data deteriorates even in the case of the remaining countries when we go back further in time.

In our analysis, we will use annual data as obtaining information on various macroeconomic time series for most of the countries is difficult. Especially, data on Arab countries are rarely available or missing. Therefore, we will use data on twenty real and nominal macroeconomic variables and construct a balanced panel for each country. Besides, we also use data on the prices of Brent oil, world real GDP, the global oil production, US CPI and annual average of the Federal Funds Rate during that period.

The data is mainly obtained from the World Development Indicators (WDI) of the World Bank. However, some missing time series are constructed using IMF database, African Development Bank database, St Louis Federal Reserve database, country state statistics offices and central banks databases. The detailed info on the sources of each time series is provided in the Appendix.

IV. Empirical Methodology

In this paper, we use different empirical methodologies to gain insights about the nature of the business cycles in the oil exporting countries. First, we draw on annual data to document stylized facts on economic fluctuations in these economies. Though, most business cycle studies are based on quarterly data, our characterization of business cycles with quarterly time series is strictly constrained by data availability issues. Accordingly, we will use per capita measures of the main economic variables with annual frequency and de-trend the natural logarithm of them using the Hodrick-Prescott (HP) filter. For the smoothing parameter, we use the standard value (100) for the annual data in the literature.

At this point, some remarks on the treatment of the data should follow. Household final consumption expenditures also include spending on durables. Typically, this component is removed from the final consumption figure when empirical studies are undertaken. This is due to the reason that this component is considered an investment spending and added to the gross investment series. Second, government final consumption spending does not include government investment and government transfers. This can reduce the robustness of our conclusions and should therefore be kept in mind when conducting the analyses.

Second, we also use principle component analysis and extract principle component of the panel on economic variables of the countries under the study. For this, we use growth values of each variable and standardize them. Then we compare these principle components with different global economic variables, mainly real oil price and world GDP, and calculate correlation figures. Moreover, we further improve our analysis and use OLS regression methods to clarify the importance of real oil price and world GDP in explaining the sources of the economic fluctuations in these countries.

Third, we invoke to the methodology proposed by Giannone, Lenza and Primiceri (2012) to analyze impulse-response functions of GDP, household consumption, government expenditure, investment and import in 13 oil exporting countries under the study. Giannone, Lenza and Primiceri (2012) propose a new methodology in choosing priors for VAR models. They show that their methodology is efficient in the case of very densely parameterized VAR estimation which is very relevant in our case. In our estimation, the number of observations is very limited when compared to the number of variables included in the estimation which significantly reduce the degrees of freedom and increase uncertainty intervals. Their methodology allows us to introduce different priors on the coefficients of the VAR estimations and increase the robustness of our empirical results.

The first prior is the Minnesota prior proposed by Litterman (1980, 1986) which shrinks the VAR coefficients towards a naive model. The second prior is the Inverse-Wishart prior introduced on the distribution of the error term in the VAR model. The third prior is the sum-of-coefficients prior introduced by Doan, Litterman and Sims (1984) which allows to benefit from any information present in the levels of the variables. The last one is the single-unit root prior

due to Sims (1993). Giannone, Lenza and Primiceri (2012) treat these hyperparameters as additional parameters to be chosen and evaluate hyperparamters at their posterior distribution.

We set the standard deviation of the Minnesota prior $\phi = 0.2$, standard deviation of the sum-of-coefficients (SoC) prior $\mu = 1.0$, the standard deviation of the single-unit-root parameter $\theta = 1.0$ and the diagonals of the scale matrix (of IW prior) are set using the residual variance of AR(1) process.

To construct impulse-response uncertainty intervals, we use the following MCMC algorithm:

i) Draw hyperparamters λ from its posterior distribution $p(\lambda \mid Y)$ using the Metropolis-Hastings algorithm

ii) Draw coefficients and their covariance matrix (β, Σ) from $p(\beta, \Sigma \mid Y)$ which is Normal-Inverse-Wishart

For the impulse response analysis, we slightly change the identification methodology proposed by Kilian (2009) to identify the oil supply, global demand, oil demand and country specific shocks. We use the variables on global oil production (Y_{oil} whose respective reduced form error is denoted by e^{oil}_{prod}), world GDP (Y^{w}_{gdp} whose respective reduced form error is denoted by e^{w}_{gdp}) oil price (π_{oil} whose respective reduced form error is denoted by e^{oil}_{price}) and country specific variable (Y_i whose respective reduced form error is denoted by e_i) and identify four structural shocks (oil supply ε^{s}_{oil}, global demand ε^{d}_{global}, oil demand ε^{d}_{oil} and country specific ε_i shocks) using the Cholesky decomposition:

$$\begin{pmatrix} e^{oil}_{prod} \\ e^{w}_{gdp} \\ e^{oil}_{price} \\ e_i \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{pmatrix} \begin{pmatrix} \varepsilon^{s}_{oil} \\ \varepsilon^{d}_{global} \\ \varepsilon^{d}_{oil} \\ \varepsilon_i \end{pmatrix}$$

Therefore, in the impulse-response analysis, we replace the country specific variable (Y_i) with GDP, household consumption, government consumption expenditure, investment and import of each country in the sample and run the impulse-response for each of them.

V. Empirical Results

We discuss the main empirical results in three sections. The first section presents some stylized facts about the business cycles of the economies in our sample. The following section describes

the sources of fluctuations in these economies using PC-analysis. The third section provides the main findings from the impulse-response analysis.

Business Cycle Facts

To study business cycles, first, we de-trend the data using the Hodrick-Prescott filter using the smoothing parameter $\lambda = 100$ and then we compute second moments of each variable of interest. The corresponding business cycle statistics are provided in the Table 1-2 in the Appendix.

In this paper, we define "absolute volatility" as the standard deviation of the series, "relative volatility" as the ratio of the standard deviation of the series to the standard deviation of the real GDP series. We compute absolute volatility only for real GDP and relative volatility for the rest of the series. Variables are defined "procyclical" if they are positively correlated with real GDP series, "countercyclical" if they are negatively correlated with real GDP and "acyclical" if they are not correlated with real GDP. We report figures for 'cyclicality' in the table in addition to "phase shift". "Cyclicality" reflects the highest correlation with real GDP considering 3 lag/lead periods where "phase shift" shows the corresponding period. A negative "phase shift" indicates that the corresponding variable leads the cycle, whereas a positive figure shows the reverse. The degree of persistence is captured by the first order autoregressive coefficient of the AR(1) process.

GDP. The volatility of real GDP significantly varies across the countries in the sample. The highest volatility is observed in the case of Azerbaijan, whereas Norway and Algeria real GDP figures enjoy the lowest volatilities. When persistence of real GDP is considered, it is clear that all countries have sufficiently high persistence level when compared to the world averages in the literature. Norway, Russia and Venezuela have relatively low persistence indicators. It is interesting that Azerbaijan has the highest volatility as well as persistence level in the sample.

Industrial Production. In general, industrial production is as volatile as real GDP.The highest volatility is observed in the case of Nigeria and Azerbaijan. Not surprisingly, it is also highly correlated with output except Nigeria and Oman. The negative correlation figures for those countries are inconsistent with economic intuition. It might be related to the phase differences between the industrial oil production cycles and the domestic production cycles. Except Saudi Arabia, all countries have highly persistent industrial production series.

Private Consumption. As in most of the emerging countries, private consumption is sufficiently volatile for all countriesexcept Norway and Kazakhstan. However, the persistence level is small in the case of Kazakhstan which also demonstrates counterintuitive correlation with output. The highest volatility is computed in the case of Nigeria, however, as in the case of Kazakhstan it exhibits a negative correlation with output and lower persistence level. Except Algeria, Angola, Kazakhstan and Nigeria, all countries have sufficient persistence and

significantly positive correlation figures with output. In the case of Azerbaijan and Saudi Arabia, private consumption expenditures are leading the cycle, whereas in Kuwait the corresponding time series lags the cycle.

Investment. UAE has the lowest investment volatility in the sample, even lower than the average of advanced countries in the literature. In fact, if we look at the sample, the relative investment volatility is smaller when compared to the world or advanced countries averages in the literature. This is more probably related to the dominance of public investment spending in the composition of the overall investment expenditures. Not surprisingly, rent seeking governments of oil rich countries are reluctant to reduce public investment expenditures. The highest volatility is computed in the case of Algeria and Nigeria. Besides, in Algeria, Iran, Nigeria and Oman investment is negatively correlated with output, which runs contrary to the intuition. Norway and Kazakhstan have the highest persistence in the sample. In Azerbaijan and Saudi Arabia, investment leads the cycle whereas in Angola, Kuwait and UAE it lags the cycle.

Government Consumption. Norway and Russia have the lowest relative volatility in the sample, even lower than the advanced country averages. In contrast, Nigeria has the highest relative volatility, which can be considered an outlier. Government consumption is countercyclical in Algeria, Norway and Oman. In Algeria, Angola, Iran, Norway and UAE government consumption leads the cycle, whereas in Nigeria, Oman and Russia it lags the cycle.

Exports. In most of the countries, the relative volatility of exports can be considered lower than advanced countries and world averages.Relative export volatility is the highest in Nigeria and Saudi Arabia, the lowest in Russia and Venezuela. Export persistence is consistent with the world and advanced country averages, except Iran. As expected, exports are procyclicaland highly correlated with output in all countries, except Venezuela.

Imports. Relative import volatility is the highest in Iran and Nigeria, but the lowest in Kuwait and UAE. Iran, Kuwait and Saudi Arabia have the highest persistence in imports. Imports are procyclical in all countries and highly correlated with output when compared to the world and advanced country averages.

M1/M2. The highest monetary aggregate volatilities are computed in Angola and Iran, whereas the lowest volatilities are recorded in Gulf countries. Angola has the lowest persistence, whereas Iran has the highest persistence. In most of the countries, the monetary aggregates are strongly correlated with output, but cyclicality differs from one country to another. In Algeria, Angola, Nigeria and UAE M1lags the cycle, but in Kuwait, Norway, Russia, Saudi Arabia, and Venezuela M1 leads the cycle. In some countries, M2 behaves differently than M1.

CPI. Similar to M1, Angola has the highest volatility among the countries in the sample, whereas Kuwait and Norway enjoy the lowest volatilities. Russia has the highest CPI relative volatility among the CIS countries, whereas Azerbaijan has the lowest one. Gulf countries have

the highest persistence of the price index. CPI does not exhibit a clear pattern, i.e. in some countries, it is procyclical whereas in other countries countercyclical.

Inflation. As in the case of CPI, inflation has the highest volatility in Angola among the countries in the sample, whereas Azerbaijan has the highest volatility among CIS countries. Persistence of inflation is not very strong, but it is negative in some countries. The pattern of cyclicality also varies from one country to another.

Sources of Fluctuations

In this section, we investigate the possible driving forces of economic business cycles using principle component analysis. Using the panel dataset on 13 countries, with 20 variables for each of them, 15 principle components are extracted. The calculations show that these 15 components explain 99% of variations in the data. It is worth noting that the first component explains only 23% of variation, whereas the first four components are responsible for only 57% of variations in the data.

We also compare the extracted principle components with real oil price and world GDP. For that, we calculate the correlation coefficient of real oil price and world GDP with each principle component. From these calculations, it seems that the real oil price is highly correlated with the first five principle components, the third component being the highest among them (the correlation coefficient is 0.46). In turn, the real world GDP is highly correlated with the first two components, the first component taking the highest value (the correlation coefficient is 0.67) (Figure 1-2). Considering the fact that the first component is responsible for the highest variation in the data, it seems that world GDP is a much stronger candidate than oil price in explaining business cycle fluctuations in oil exporting countries. However, oil price is significantly correlated with world GDP as well. Thus, to further enhance our claims, we invoke to a regression analysis.

Therefore, we regress the first four principal components on the real oil prices and real world GDP. It is worth noting that all variables included in these regression analysis are standardized. Using the regression analysis, we test the statistical significance of explanatory variables. First, we introduce the oil price as an explanatory variable to the regression and then control for real world GDP later. We also test for the adequacy of regression equations using different tests (serial correlation, heteroscedasticity, etc.). The regression results are reported in the Table 6 of the Appendix. Also note that the signs of the principal components are not identified, so we ignore the sign of them and examine statistical significance of the coefficients only.

The regression analysis show that the first and the second principal components which are responsible for the most of the fluctuations in the data are significantly explained by real world GDP, but not by the real oil prices. In contrary, the real oil prices do significantly explain the

third and the fourth components whereas real world GDP becomes statistically insignificant in these regressions.

In the business cycle literature, the first candidate to explain economic fluctuations in the oil exporting countries is the terms-of-trade shocks. However, it seems that it is difficult to attribute the business cycles in the oil exporting countries to a common single factor. As regression analysis once more reveal, real world GDP is a more strong candidate than an oil factor to be an important source of economic fluctuations in these countries. This claim is further investigated using the impulse-response analysis in the next section.

Impulse-Response Analysis

To investigate the possible sources of economic fluctuations and to test the claim that global demand plays at least as important role as the oil factor, we apply Bayesian VAR approach due to Giannone, Lenza and Primiceri (2012). We use the natural logarithm of each variable included in VAR and choose the lag length of two due to shorter length of time series. We identify four shocks, namely, oil supply, global demand, oil demand and country specific shocks. We run the impulse-response analysis for GDP, household consumption, investment, government consumption expenditures and imports for 13 countries under the study (see impulse-response figures in the appendix).

GDP. This macroeconomic indicator of the oil exporting countries under the study responds positively to an oil supply shock, but responses of only 7 countries(out of 13) (Kuwait, Nigeria, Norway, Russia, Saudi Arabia, UAE and Venezuela) are statistically significant. In the rest of the countries, GDP does not react significantly to an oil supply shock. Only three countries (Nigeria, Russia and Saudi Arabia) whose GDP rose after a positive oil supply shock, demonstrate an upward movement after an oil demand shock as well. Only Kazakhstan which does not react to a positive oil supply shock, responds positively to an oil demand shock. However, almost all countries except four of them, experience significant improvement in their domestic production levels after a global demand shock. Only one, namely, Algeria does not significantly react to any of these three shocks.

Household consumption. Only five of those oil exporting countries significantly react to oil supply and demand shocks. In these countries, household consumption significantly rises after a positive oil supply or demand shock. It is very interesting that in Angola, an oil demand shock reduces household consumption. A positive global demand shock increases household consumption in 7 countries (Algeria, Kuwait, Norway, Oman, Russia, UAE and Venezuela). Only three countries (Algeria, Norway and Russia) exhibit a statistically significant improvement due to all three shocks.

Government expenditure. Only four of the countries (Angola, Azerbaijan, Nigeria, UAE) under the study do not significantly react to a positive oil demand shock, whereas only three countries (Norway, Saudi Arabia, Venezuela) respond significantly to an oil supply shock. It is worth emphasizing the finding that a positive oil supply or oil demand shock leads to a reduction in the government consumption expenditures in Norway. Six countries (Algeria, Azerbaijan, Kuwait, Oman, Saudi Arabia, UAE) demonstrate a significant response to a global demand shock. Only government expenditures in Saudi Arabia react statistically significant to all three shocks of interest.

Investment. An oil demand shock explains a significant portion of fluctuations of investment expenditures in almost all countries, except five (Algeria, Azerbaijan, Iran, UAE, Venezuela). Interestingly, a positive oil demand shock causes a decline in investment expenditures in most of the countries (Kuwait, Nigeria, Norway, Oman, Saudi Arabia). An oil supply shock also leads to statistically significant responses in five countries (Algeria, Nigeria, Norway, Oman, Russia). In contrary, a global demand shock seems to be a less relevant source of fluctuations in investment expenditures when compared to the other variables of interest. It only leads to a positive significant responses of investment in Kazakhstan, Norway, Russia and UAE.

Imports. An oil supply and a global demand shocks seem to be a driving forces behind the fluctuations of imports in most of the countries. Only in Algeria, Angola, Iran, Kuwait and Saudi Arabia imports do not significantly react to a positive oil supply shock. However, in Angola and Saudi Arabia the imports respond significantly to an oil demand shock. In contrary to the case of investment expenditures, a global demand shock is now playing an important role in explaining the fluctuations of imports to the country.

Overall, the impulse-response analysis once more emphasize the importance of a global demand factor in explaining economic fluctuations in the oil exporting countries. It shows that a global demand shock is at least as important as the oil supply/demand shocks to the economies of those countries. The second finding of the impulse-response exercises is consistent what is claimed in the previous sections of the paper. That is, the response dynamics of oil exporting countries are significantly heterogeneous and it is difficult to talk about a significant common dynamics in oil exporting countries.

So, is there an oil country factor or is there an oil business cycle? It is tempting to answer negatively. Though there seems no clear consensus in the literature whether the source of business cycles in oil exporting countries is the terms-of-trade shocks, some studies find that the main source of business cycles in these countries may differ substantially (see Rafiq (2011), Mehrara and Oskoui (2007), Korhonen and Mehrotra (2009)). In fact, the organization of economic activity and the quality of institutions play an important role smoothing out fluctuations in those countries (Arezki, et al (2011)).

Although these studies underline the importance of institutional factors as the main cause of differences in the nature and the sources of economic fluctuations in these economies, it is highly probable that the rising global political and economic integration also play a significant role. With increasing integration to world economic systems, the oil exporting countries become more susceptible to world business cycles, the sources of the economic fluctuations become more diversified, and consequently, the role of oil has declined over time.

However, we need to take into account that the sample period also includes the recent crisis years. It is probable that this decline in the significance of oil and consequently, the relative rise of the influence of the world business cycles on oil exporting economies is a temporary rather than a trend phenomenon. So, we think that this claim should be tested further using larger dataset on these countries. In our case, the sample size is relatively small and it is difficult to pursue our analysis by further splitting the sample.

VI. Conclusion

In this paper, we investigate business cycle regularities in oil exporting countries. Using annual data, first, we document stylized facts about business cycles in these economies. Results show that business cycles in these countries display important differences from advanced countries. These economies, especially new emerging ones, are more volatile than the developed world. They also exhibit sufficient diversity among them. That is, contrary to widely held beliefs, it is difficult to find a common set of dynamics and business cycle patterns in oil exporting countries.

Besides, we also explore possible sources of economic fluctuations in these economies. The empirical analysis shows that there is no single candidate as a main source of economic fluctuations in these economies. Especially, an oil price shock does not seem to explain the majority of variation in economic variables. The macroeconomic aggregates in these economies are highly correlated with world GDP, showing that they are exposed to world business cycles, which have a strong effect on them.

In the previous sections, we have seen that various studies underline the important influence of the organization of economic activity and the quality of institutions on the nature and the sources of economic fluctuations in oil exporting countries. However, it is also possible that recent global economic and political developments have reduced the significance of these factors in these economies as well. Especially, increasing global economic integration can make the role of oil decline as the main source of economic fluctuations in oil exporting countries. In other words, with rising integration, the sources of economic fluctuations in the oil exporting countries have also become diversified and consequently, the role of the oil has declined over time.

However, we think that this claim should be tested further by using a larger dataset and also, dropping the recent crisis years. Second, the future line of research might apply the business

cycle accounting methodology recently developed by Chari, Kehoe and McGrattan (2007) to study business cycles in oil exporting countries. We consider that these two directions of research can contribute to our understandings of the business cycles in oil exporting countries and the role of global economic integration extensively.

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Appendix

Table 1. Data Source Description

	Unit	Countries						
		Algeria	**Angola**	**Azerbaijan**	**Iran**	**Kazakhstan**	**Kuwait**	**Nigeria**
Broad money	current LCU	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Consumer price index	2005 = 100	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Export volume index	2000 = 100	WDI	WDI, ADB	WDI	WDI	WDI	WDI	WDI
Final consumption expenditure	constant 2005 US$	WDI	WDI, ADB	WDI	WDI	WDI	WDI, ArabStats	WDI, ADB
GDP	constant 2005 US$	WDI	WDI	WDI	WDI	WDI	WDI	WDI
General government final consumption expenditure	constant 2005 US$	WDI	WDI, ADB	WDI	WDI, UN stats	WDI	WDI, ArabStats	WDI, ADB
Gross capital formation	current US$	WDI	WDI, ADB	WDI	WDI, UN stats	WDI	WDI	WDI, ADB
Gross fixed capital formation	constant 2005 US$	WDI	WDI, ADB	WDI	WDI	WDI, UN stats	WDI, ArabStats,	WDI, ADB, SO
Household final consumption expenditure, etc.	constant 2005 US$	WDI	WDI, ADB	WDI	WDI, UN stats	WDI	WDI, ArabStats	WDI, ADB
Imports of goods and services	constant 2005 US$	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Industry, value added	constant 2005 US$	WDI	WDI	WDI	WDI, UN stats	WDI	WDI, ArabStats, SO	WDI, SO
Inflation, consumer prices	annual %	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Manufacturing, value added	constant 2005 US$	WDI	WDI	WDI	WDI, UN stats	WDI	WDI, ArabStats, SO	WDI, SO
Services, etc., value added	constant 2005 US$	WDI	WDI	WDI	WDI, UN stats	WDI	WDI, ArabStats, SO	WDI, ADB
Money	current LCU	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Money and quasi money (M2)	current LCU	WDI	WDI	WDI	WDI	WDI	WDI	WDI
Labor force, total		WDI	WDI	WDI	WDI	WDI	WDI	WDI
Population		WDI	WDI	WDI	WDI	WDI	WDI	WDI

* WDI denotes World Development Indicators from the World Bank, ADB is African Development Bank, UN stats is UN statistics, SO is the Statistical Office of the respective country.

Table 1. Data Source Description (Cont'd)

	Unit	Countries						
		Norway	**Oman**	**Russia**	**Saudi Arabia**	**UAE**	**Venezuela**	**Other**
Broad money	current LCU	WDI, OECD	WDI	WDI	WDI	WDI	WDI	
Consumer price index	2005 = 100	WDI	WDI	WDI	WDI	WDI	WDI	
Export volume index	2000 = 100	WDI	WDI	WDI	WDI	WDI	WDI	
Final consumption expenditure	constant 2005 US$	WDI	WDI, ArabStats, SO	WDI	WDI, ArabStats	WDI, ArabStats	WDI	
GDP	constant 2005 US$	WDI	WDI	WDI	WDI	WDI	WDI	
General government final consumption expenditure	constant 2005 US$	WDI	WDI, ArabStats	WDI	WDI, ArabStats	WDI, ArabStats	WDI	
Gross capital formation	current US$	WDI	WDI, ArabStats, SO	WDI	WDI	WDI, ArabStats	WDI	
Gross fixed capital formation	constant 2005 US$	WDI	WDI, ArabStats, SO	WDI	WDI, ArabStats	WDI	WDI	
Household final consumption expenditure, etc.	constant 2005 US$	WDI	WDI, ArabStats	WDI	WDI, ArabStats, IMF	WDI, ArabStats, IMF	WDI	
Imports of goods and services	constant 2005 US$	WDI	WDI	WDI	WDI	WDI	WDI	
Industry, value added	constant 2005 US$	WDI	WDI, SO	WDI	WDI	WDI, ArabStats	WDI	
Inflation, consumer prices	annual %	WDI	WDI	WDI	WDI	WDI, ArabStats	WDI	
Manufacturing, value added	constant 2005 US$	WDI	WDI, SO	WDI, UN stats	WDI	WDI, ArabStats	WDI	
Services, etc., value added	constant 2005 US$	WDI	WDI, ArabStats, SO	WDI	WDI	WDI, ArabStats, UNDP	WDI	
Money	current LCU	SO	WDI	WDI	WDI	WDI	WDI	
Money and quasi money (M2)	current LCU	SO	WDI	WDI	WDI	WDI	WDI	
Labor force, total		WDI	WDI	WDI	WDI	WDI	WDI	
Population		WDI	WDI	WDI	WDI	WDI	WDI	

* Federal Funds Rate, US CPI and Oil price data are taken from St. Louis Fed database, World Oil Production (million tonnes) is taken from BP Historical data workbook.

Table 2. Real Variables

	Algeria	Angola	Azerbaijan	Iran	Kazakhstan	Kuwait
GDP						
Absolute volatility	1.80	7.50	10.20	2.40	5.00	6.70
Persistence	0.71	0.77	0.79	0.67	0.72	0.72
Industrial Production						
Relative Volatility	0.96	1.21	1.73	1.56	1.26	1.30
Persistence	0.55	0.81	0.80	0.61	0.70	0.54
Cyclicality/Phase shift	0.78/0	0.95/0	0.89/0	0.94/0	0.97/0	0.83/0
Private Consumption						
Relative Volatility	2.99	3.62	1.17	3.86	1.02	1.52
Persistence	0.42	0.51	0.45	0.91	0.07	0.53
Cyclicality/Phase shift	-0.30/+3	-0.82/-2	0.70/-1	0.76/0	-0.43/-2	0.75/+1
Investment						
Relative Volatility	6.02	3.29	2.23	2.02	3.21	2.75
Persistence	0.69	0.46	0.51	0.27	0.61	0.46
Cyclicality/Phase shift	-0.50/-3	0.76/+1	0.76/-3	-0.76/+3	0.89/0	0.57/+1
Government Consumption						
Relative Volatility	0.80	4.36	1.36	4.88	1.93	1.16
Persistence	0.72	-0.29	0.66	0.46	0.42	0.68
Cyclicality/Phase shift	-0.28/-3	0.45/-3	0.86/0	0.52/-2	0.79/0	0.84/0
Export						
Relative Volatility	3.01	1.41	1.69	1.82	2.08	1.25
Persistence	0.23	0.53	0.65	-0.09	0.48	0.41
Cyclicality/Phase shift	0.51/0	0.86/0	0.84/0	0.50/0	0.78/0	0.78/0
Import						
Relative Volatility	3.32	1.66	1.67	4.84	2.31	1.49
Persistence	0.10	0.43	0.52	0.77	0.34	0.61
Cyclicality/Phase shift	0.64/-1	0.76/+1	0.65/-3	0.84/0	0.71/0	0.81/0

Notes: 'Absolute volatility' is the standard deviation of the variable. 'Relative volatility' is the ratio of the standard deviation of the variable and the standard deviation of the real GDP. 'Cyclicality' is the highest correlation in absolute value between the variable and real GDP. Negative figure for 'Phase Shift' indicates that the variable leads, while positive one indicates that the variable lags the cycle. 'Persistence' is the AR(1) coefficient in the variable.

Table 3. Real Variables

	Nigeria	Norway	Oman	Russia	Saudi Arabia	UAE	Venezuela
GDP							
Absolute volatility	2.50	1.80	5.30	5.40	2.80	6.90	6.90
Persistence	0.63	0.56	0.67	0.56	0.63	0.74	0.58
Industrial Production							
Relative Volatility	2.25	1.41	0.99	1.15	1.38	0.92	0.94
Persistence	0.59	0.54	0.61	0.54	0.33	0.61	0.47
Cyclicality/Phase shift	-0.69/+3	0.73/0	-0.73/-3	0.92/0	0.82/0	0.94/0	0.97/0
Private Consumption							
Relative Volatility	28.95	1.08	1.71	1.58	2.91	1.64	1.20
Persistence	0.30	0.66	0.69	0.52	0.55	0.66	0.67
Cyclicality/Phase shift	-0.25/-3	0.65/0	0.85/0	0.83/0	0.68/-3	0.72/0	0.94/0
Investment							
Relative Volatility	8.02	5.04	3.49	2.44	2.80	1.01	3.51
Persistence	0.21	0.63	0.40	0.49	0.52	0.26	0.46
Cyclicality/Phase shift	-0.54/0	0.75/0	-0.40/+3	0.96/0	0.56/-1	0.55/+1	0.85/0
Government Consumption							
Relative Volatility	19.98	0.55	0.93	0.36	2.33	1.2	1.28
Persistence	0.21	0.54	0.46	0.61	0.33	0.61	0.15
Cyclicality/Phase shift	0.39/+1	-0.41/-1	-0.55/+2	0.70/+1	0.44/0	0.84/-2	0.64/0
Export							
Relative Volatility	4.98	1.91	1.99	1.01	4.80	1.14	0.89
Persistence	0.52	0.52	0.51	0.44	0.60	0.61	0.15
Cyclicality/Phase shift	0.65/+1	0.64/+1	0.80/+1	0.77/-1	0.31/0	0.89/0	-0.52/+2
Import							
Relative Volatility	4.26	3.22	1.85	3.23	3.48	1.54	3.13
Persistence	0.16	0.46	0.32	0.53	0.60	0.54	0.50
Cyclicality/Phase shift	0.39/-2	0.77/0	0.61/0	0.88/0	0.52/0	0.73/+1	0.94/0

Table 4. Nominal Variables

	Algeria	Angola	Azerbaijan	Iran	Kazakhstan	Kuwait
M1						
Relative Volatility	4.08	7.81	2.12	8.87	3.04	1.50
Persistence	0.48	0.04	0.48	1.03	0.27	0.62
Cyclicality/Phase shift	0.73/+2	-0.33/+2	0.75/0	0.61/0	0.56/0	0.85/-1
M2						
Relative Volatility	3.52	8.24	1.92	9.52	3.47	0.99
Persistence	0.40	0.04	0.46	0.62	0.47	0.75
Cyclicality/Phase shift	0.69/-2	-0.36/-1	0.77/0	0.58/-1	0.72/0	0.74/+2
CPI						
Relative Volatility	1.92	9.14	0.72	1.73	1.19	0.35
Persistence	0.21	0.21	0.60	0.27	0.19	0.71
Cyclicality/Phase shift	-0.39/0	-0.57/+1	0.83/+1	-0.67/-1	-0.64/-1	0.78/+3
Inflation						
Relative Volatility	2.30	93.91	7.27	2.61	5.46	0.29
Persistence	-0.02	0.25	0.20	0.11	0.32	0.07
Cyclicality/Phase shift	0.39/-1	0.48/+3	-0.33/+3	0.38/-2	0.64/0	0.36/+2

Table 5. Nominal Variables

	Nigeria	Norway	Oman	Russia	Saudi Arabia	UAE	Venezuela
M1							
Relative Volatility	5.35	3.79	2.37	2.17	1.83	1.50	3.38
Persistence	0.44	0.60	0.42	0.55	0.72	0.67	0.34
Cyclicality/Phase shift	0.39/+3	-0.82/-3	0.63/0	0.73/-1	0.59/-1	0.81/+1	0.75/-1
M2							
Relative Volatility	5.19	2.40	2.11	1.75	1.90	1.22	2.17
Persistence	0.64	0.63	0.71	0.78	0.73	0.76	0.51
Cyclicality/Phase shift	0.50/+3	-0.75/-3	0.79/0	0.81/-1	0.63/-1	0.83/+2	0.85/-1
CPI							
Relative Volatility	1.63	0.45	0.60	2.19	1.08	0.70	1.78
Persistence	0.30	0.40	0.78	0.52	0.85	0.82	0.22
Cyclicality/Phase shift	-0.72/+3	-0.61/-1	0.64/+1	-0.60/+2	0.65/0	-0.89/-2	0.50/+3
Inflation							
Relative Volatility	4.48	0.49	0.42	5.86	0.72	0.37	1.61
Persistence	0.20	-0.22	0.31	-0.08	0.28	0.18	-0.06
Cyclicality/Phase shift	-0.73/+3	-0.49/-2	-0.58/+3	0.34/-1	0.64/-3	0.54/0	-0.58/+1

Table 6. Regression analysis

	component1	**component2**	**component3**	**component4**
component1(-1)	0.75***	-	-	-
component2(-1)	-	0.56***	-	-
component3(-1)	-	-	-	-
component4(-1)	-	-	-	0.60***
real oil price	-0.06	0.07	-0.22***	0.22***
real world GDP	-0.28***	0.11*	0.10	-0.09
	$R^2 = 0.84$	$R^2 = 0.75$	$R^2 = 0.33$	$R^2 = 0.48$

Note: *** denotes the significance of the respective coefficient at 1%, ** at 5%, * at 10% significance level. Various tests show that there is no serial correlation or heteroscedasticity in the regression equations.

Figure 1.Real oil price and third Principle Component

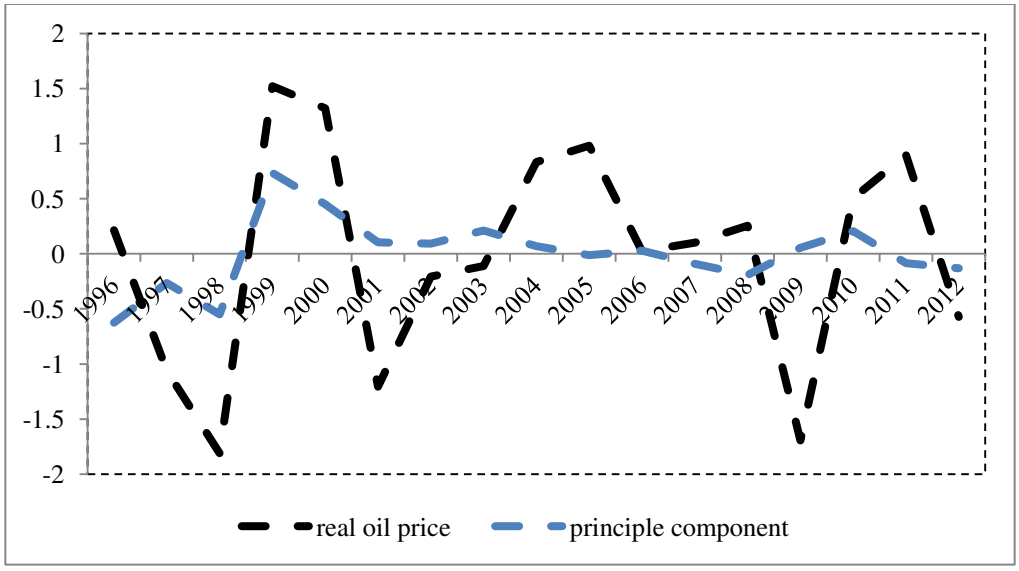
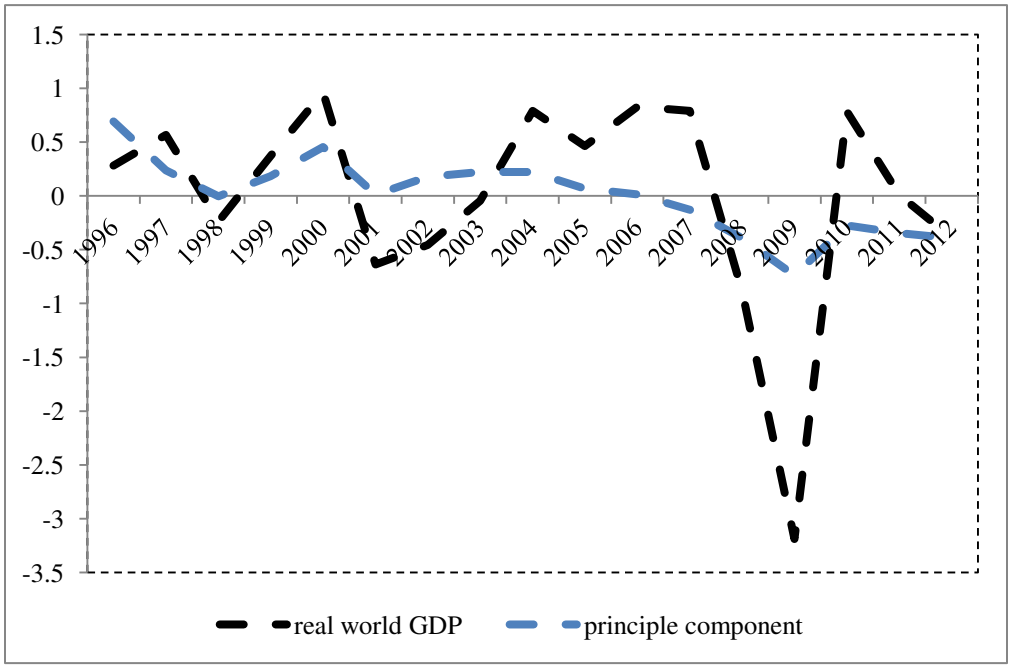
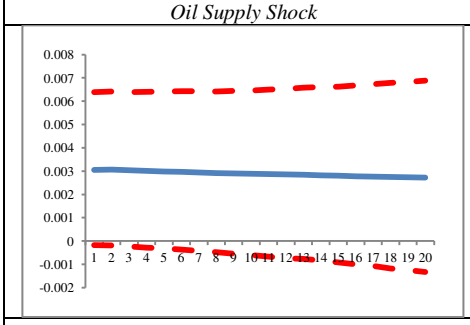
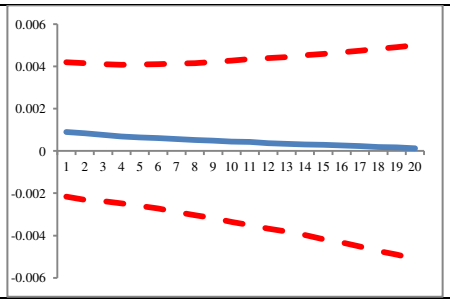
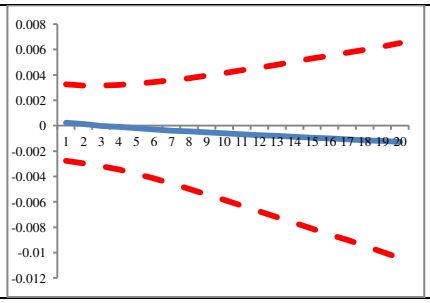


Figure 2.Real world GDP and second Principle Component

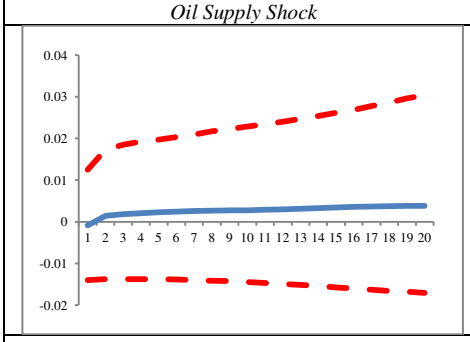
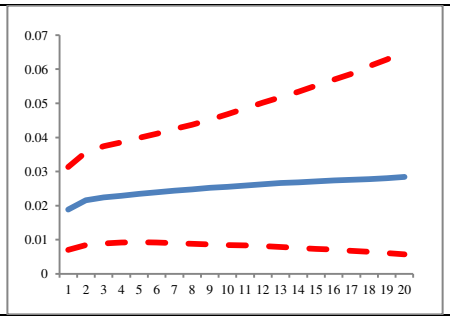
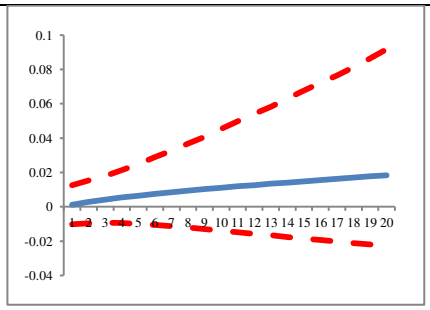


The Response of GDP, 68% CI

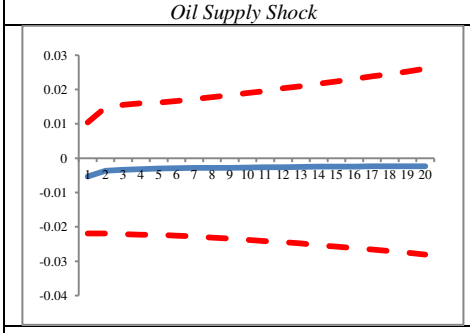
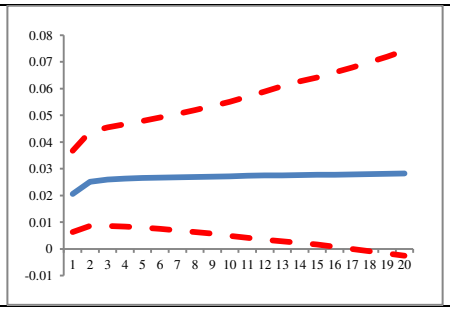
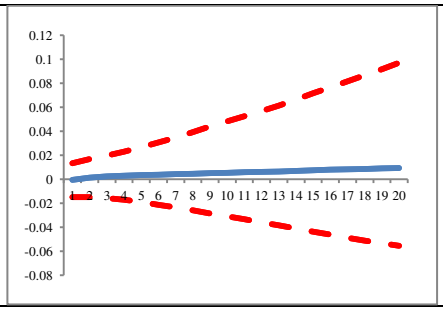
Algeria

Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		

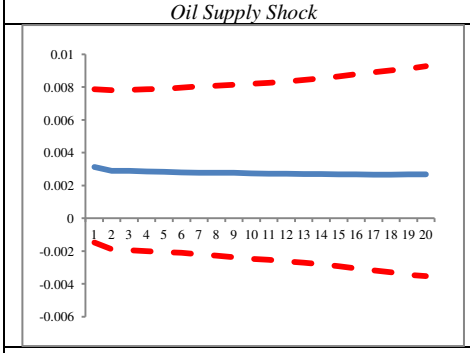
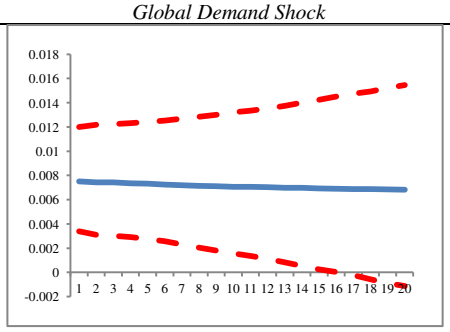
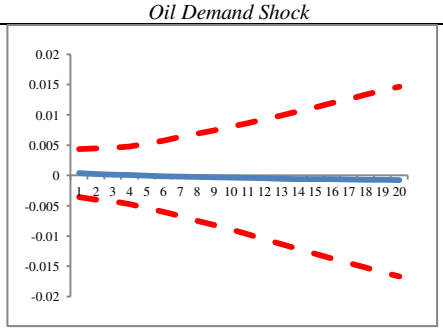
Angola

Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		

Azerbaijan

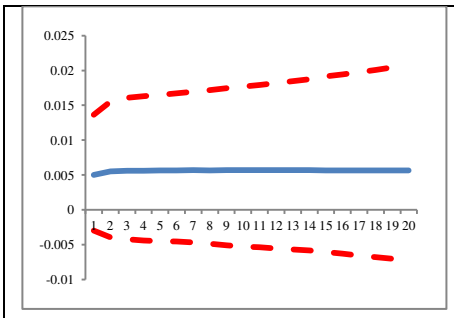
Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		

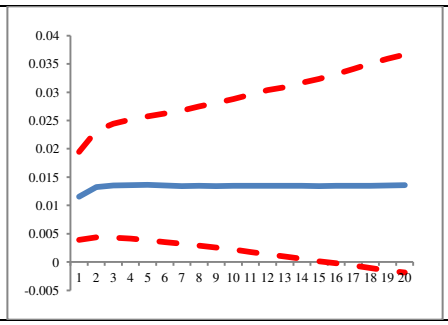
Iran

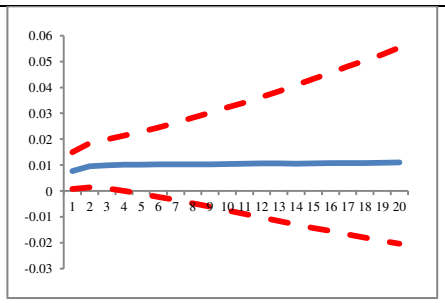
Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		

Kazakhstan

Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*

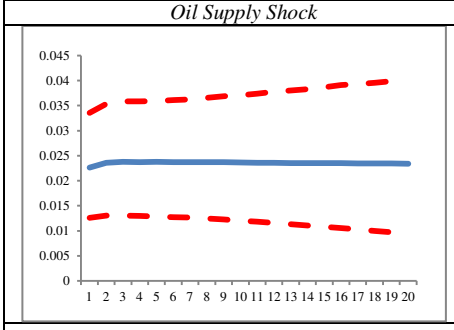


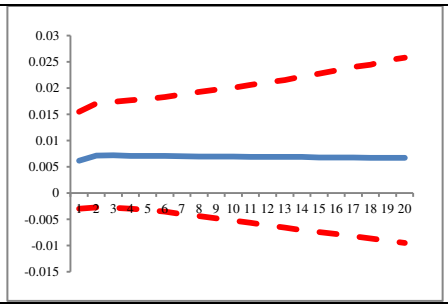


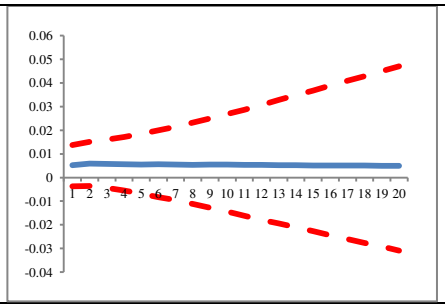


Kuwait

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

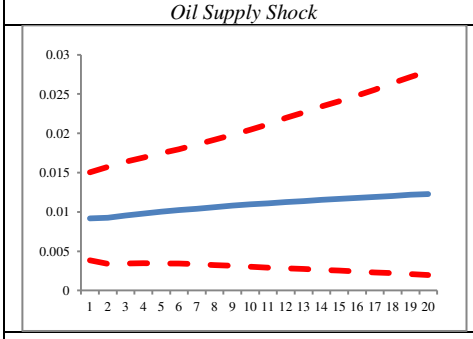


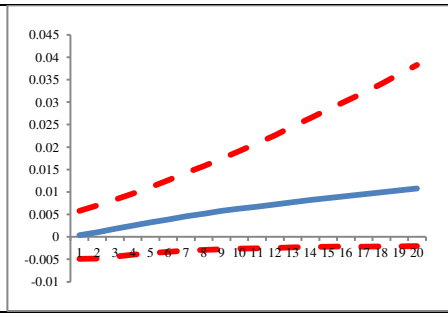


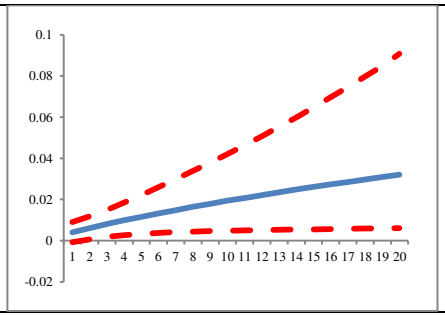


Nigeria

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

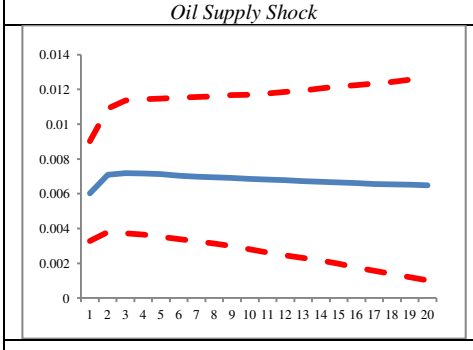


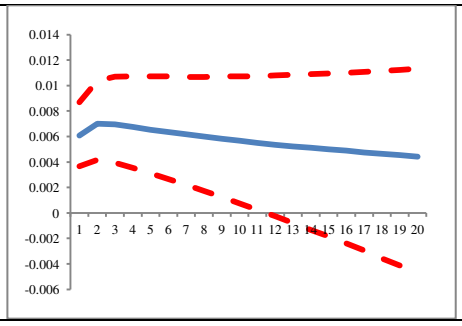


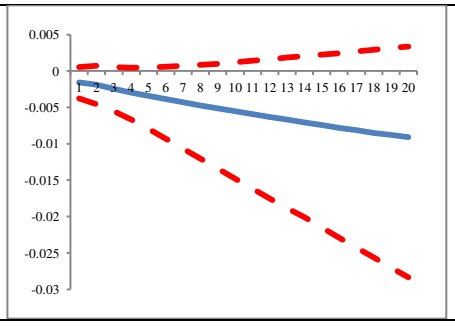


Norway

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

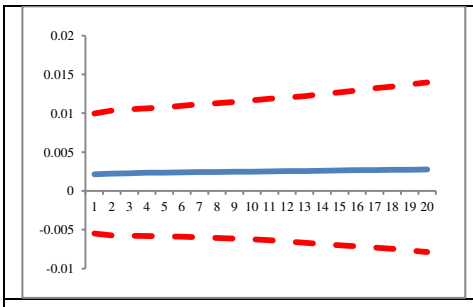


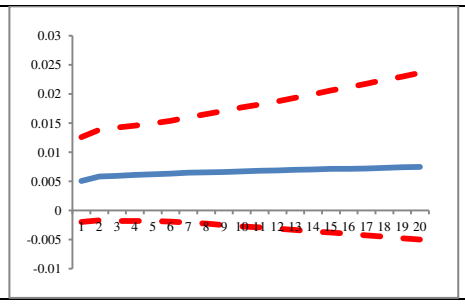


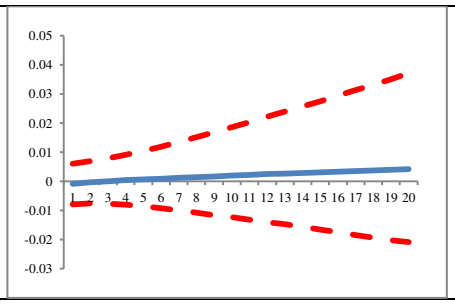


Oman

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

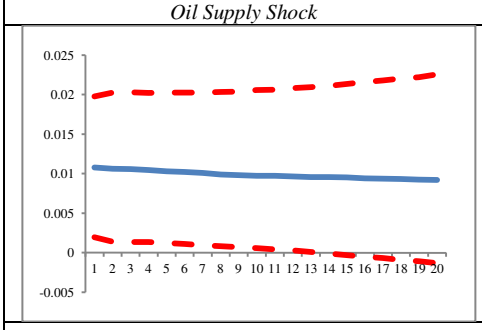


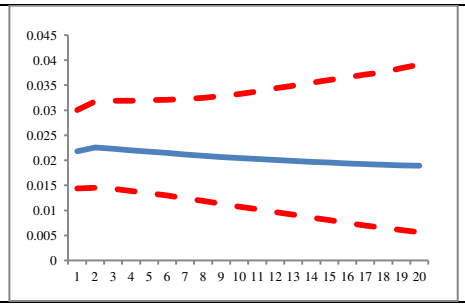


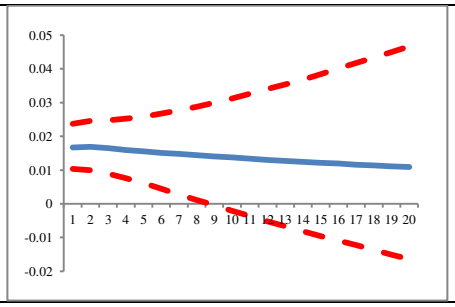


Russia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

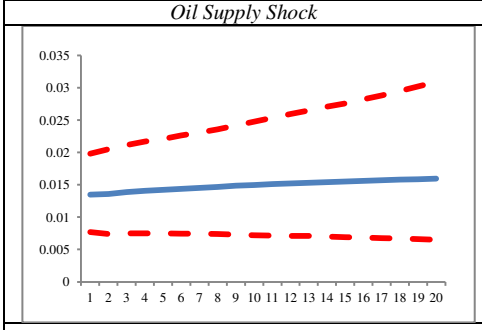


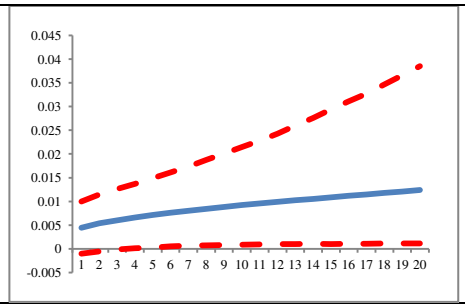


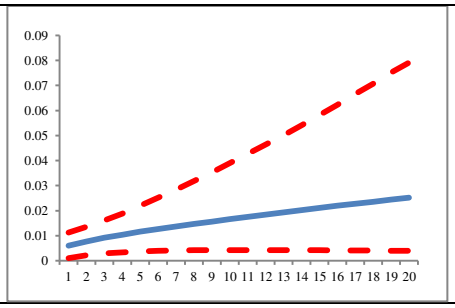


Saudi Arabia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

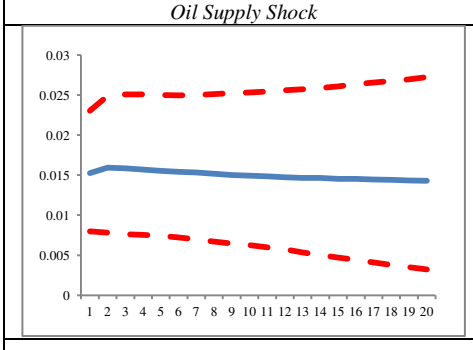


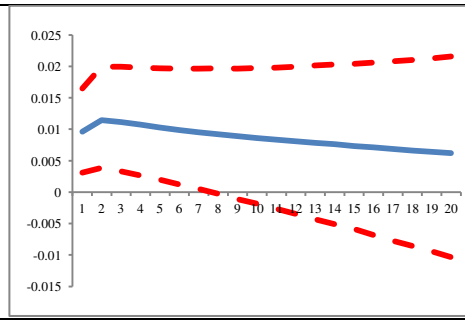


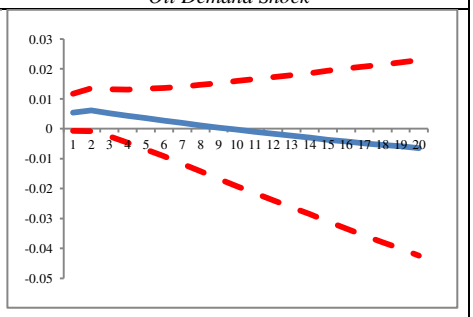


UAE

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

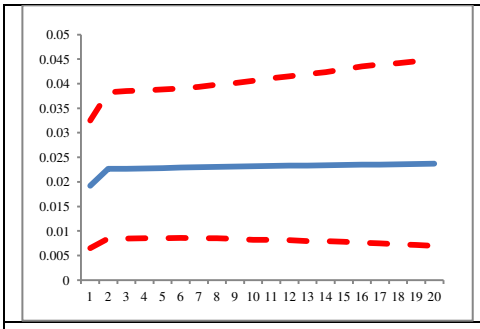


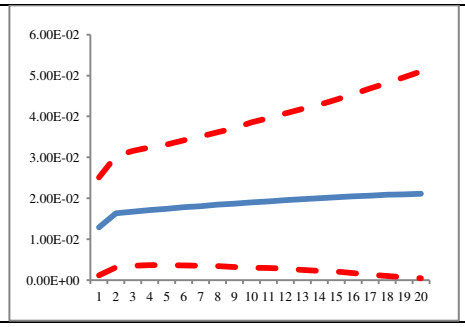


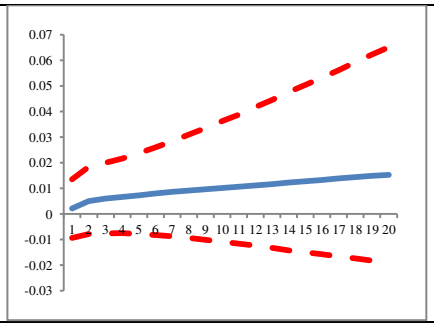


Venezuela

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*



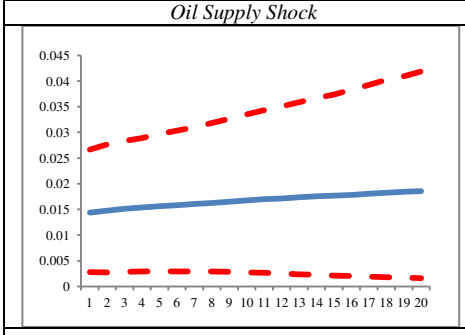




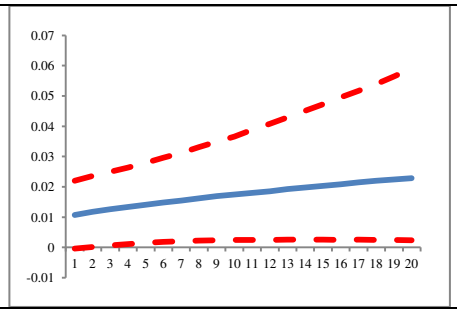
The Response of Household consumption, 68% CI

Algeria

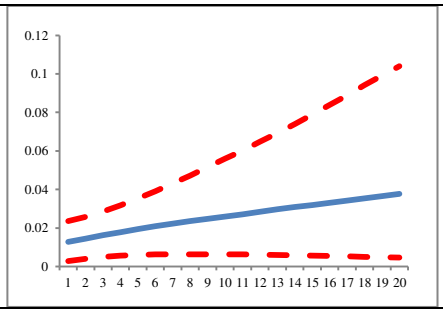
Oil Supply Shock



Global Demand Shock

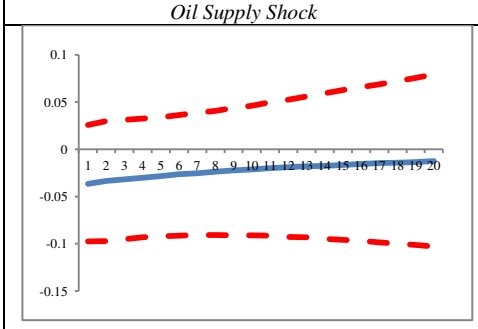


Oil Demand Shock

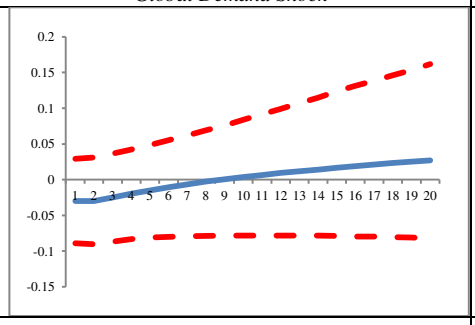


Angola

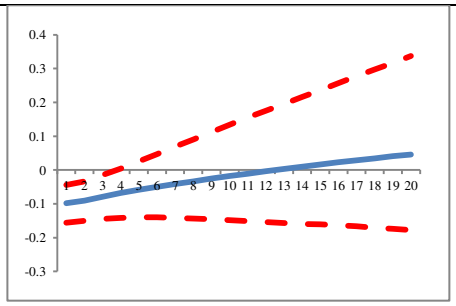
Oil Supply Shock



Global Demand Shock

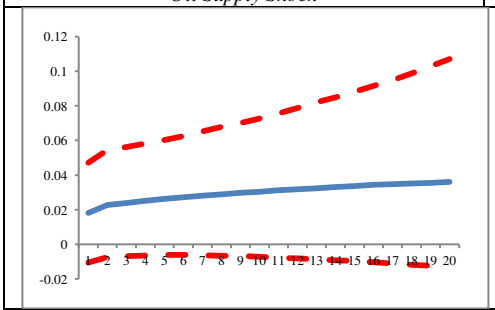


Oil Demand Shock

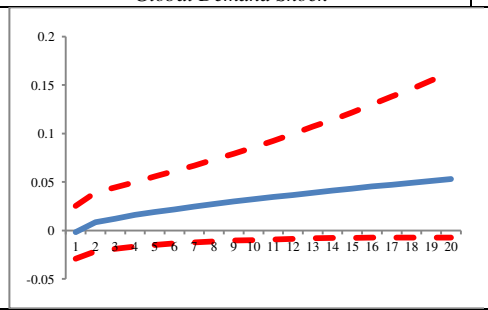


Azerbaijan

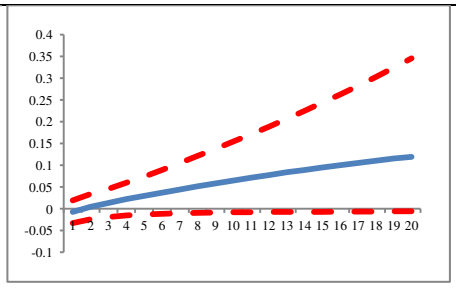
Oil Supply Shock



Global Demand Shock

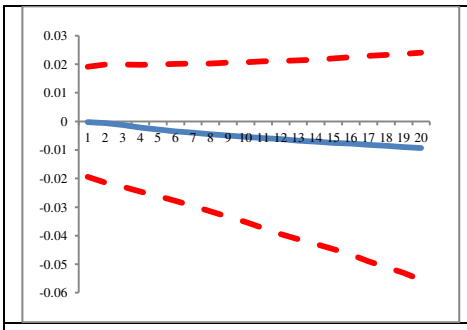


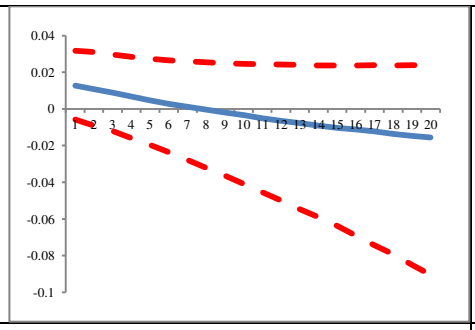
Oil Demand Shock

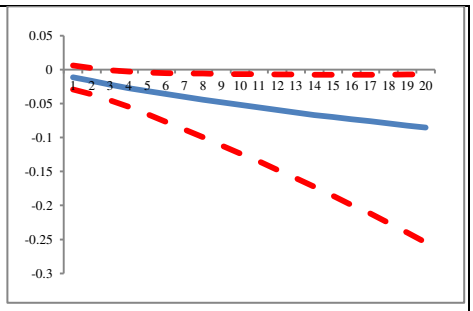


Iran

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

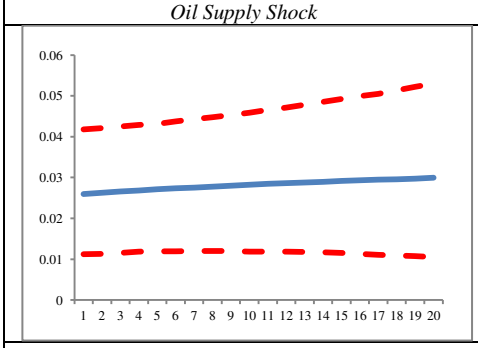


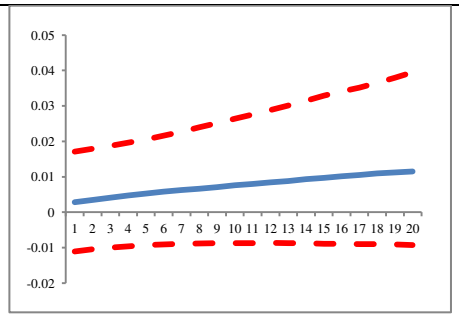


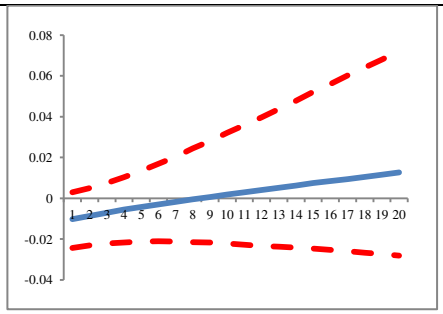


Kazakhstan

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

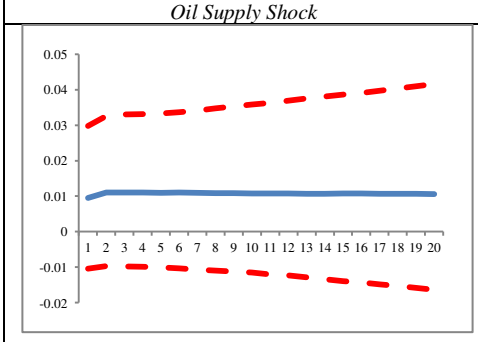


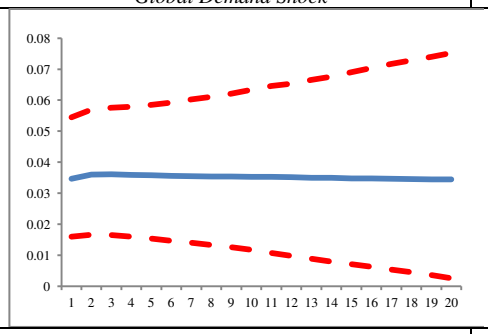


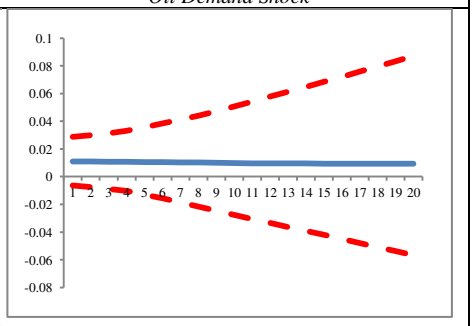


Kuwait

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

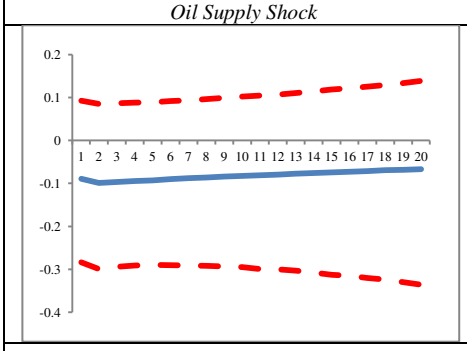


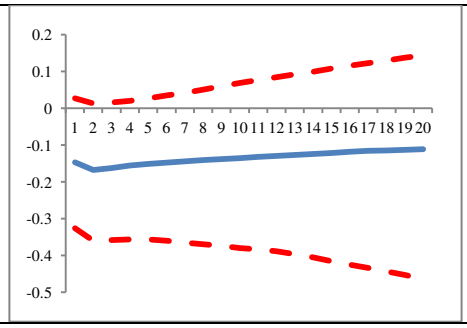


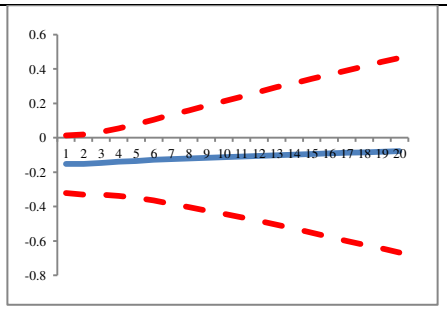


Nigeria

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

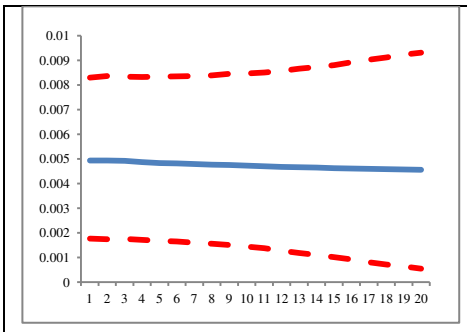


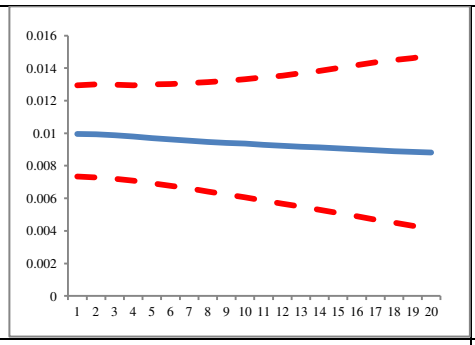


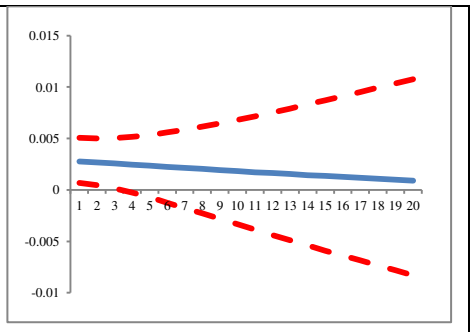


Norway

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

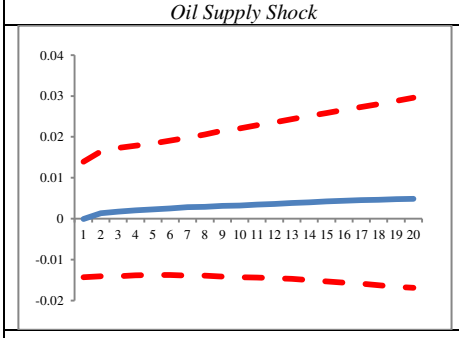


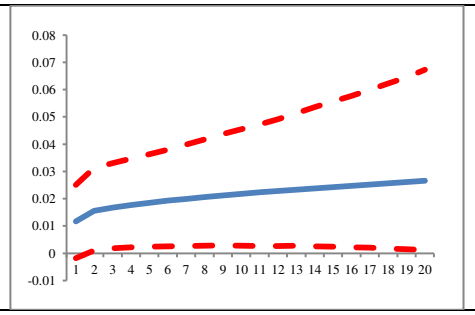


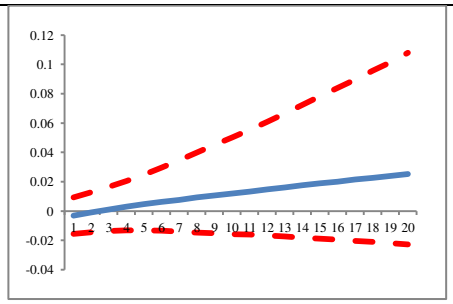


Oman

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

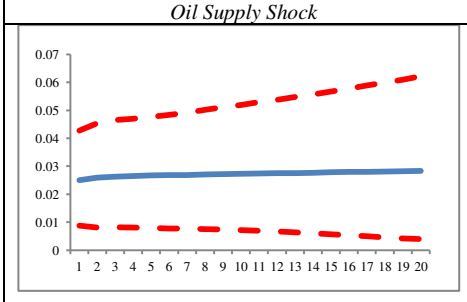


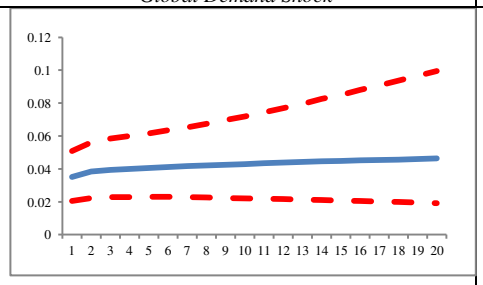


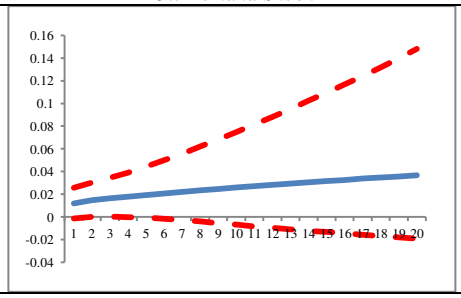


Russia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

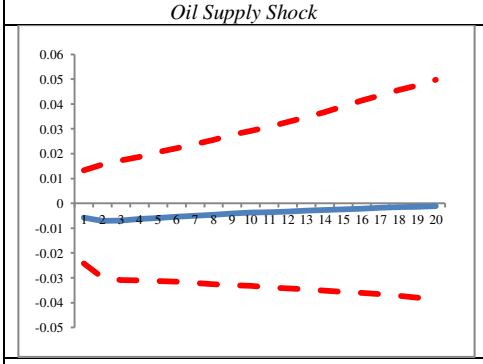


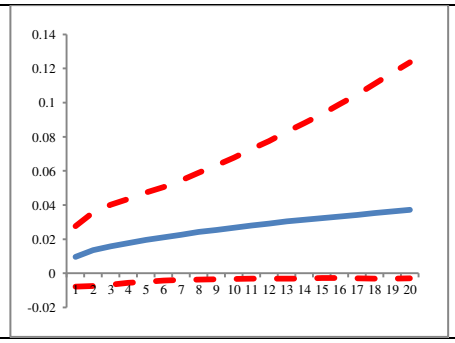


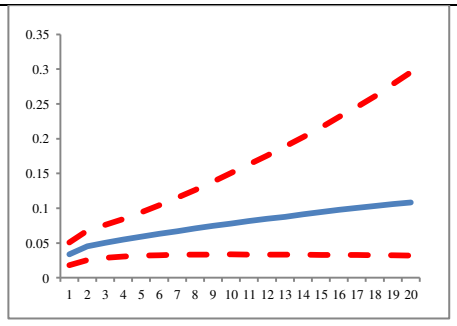


Saudi Arabia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

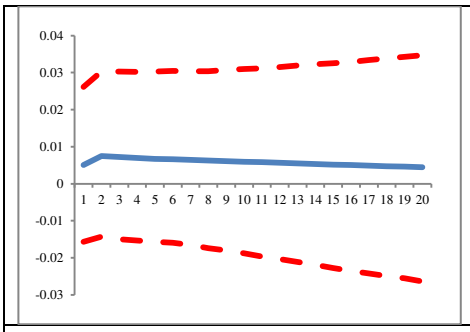


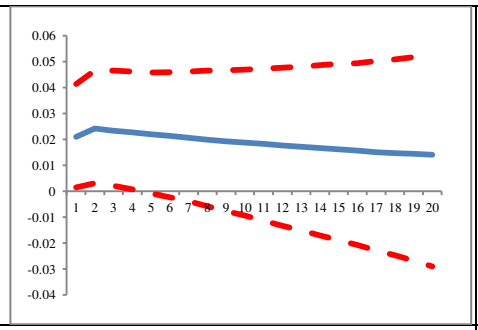


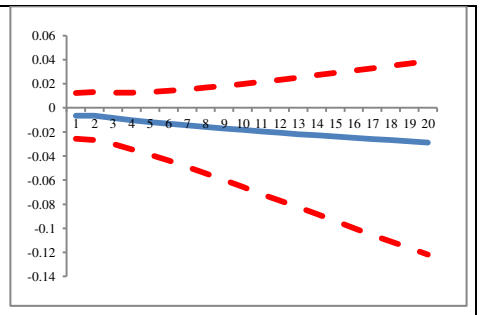


UAE

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

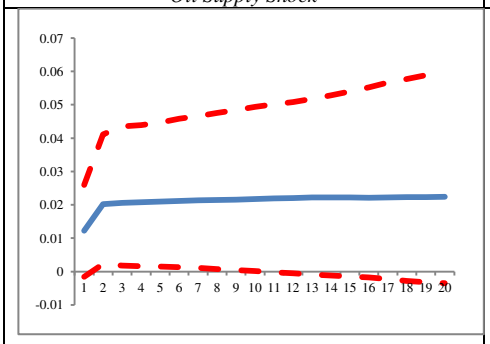




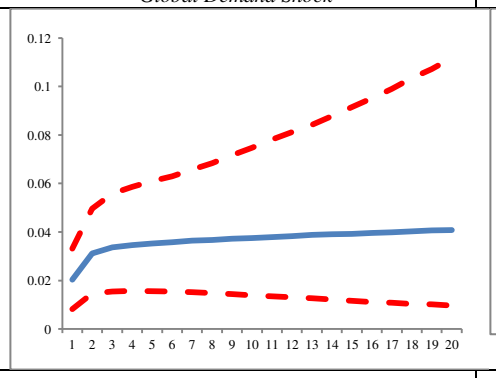


Venezuela

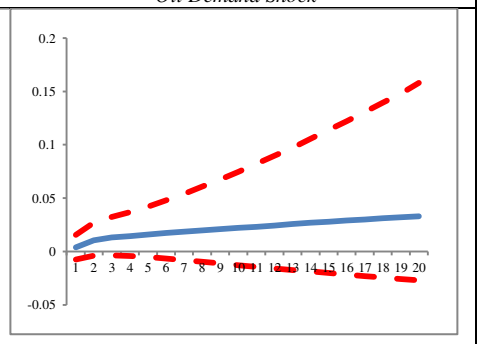
Oil Supply Shock



Global Demand Shock



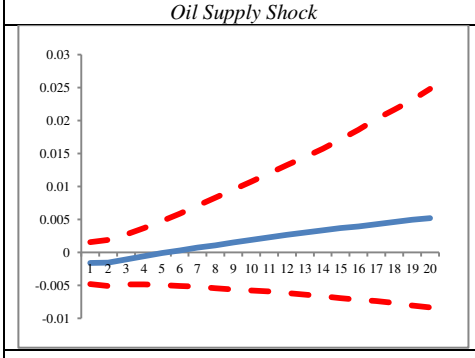
Oil Demand Shock



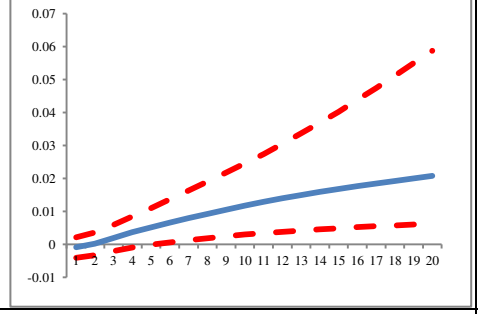
The Response of Government Expenditure, 68% CI

Algeria

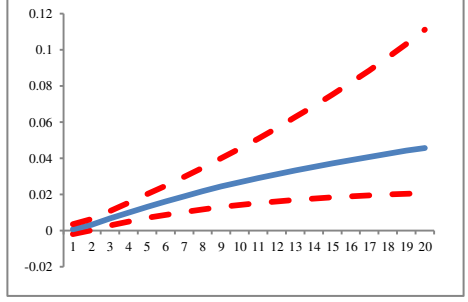
Oil Supply Shock



Global Demand Shock

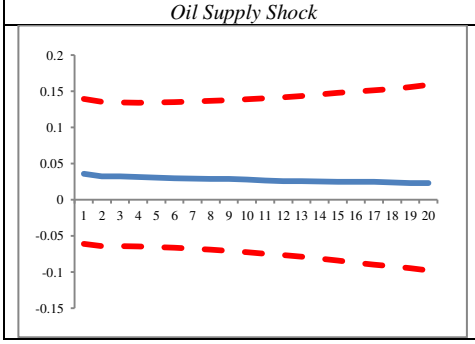


Oil Demand Shock

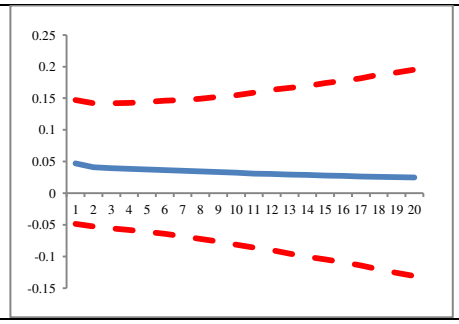


Angola

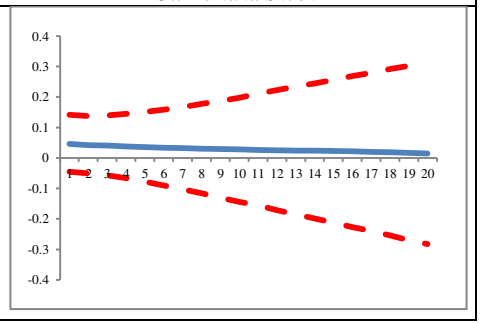
Oil Supply Shock



Global Demand Shock

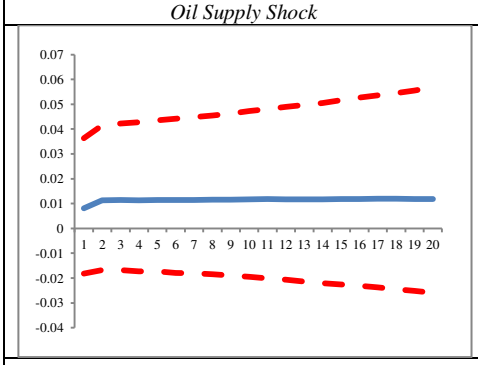


Oil Demand Shock

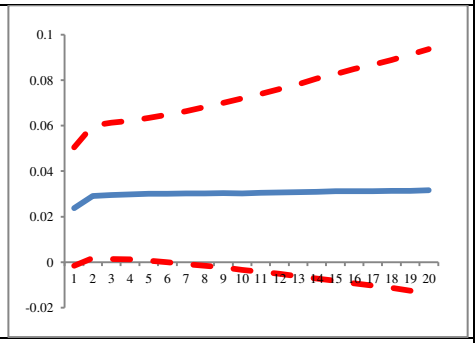


Azerbaijan

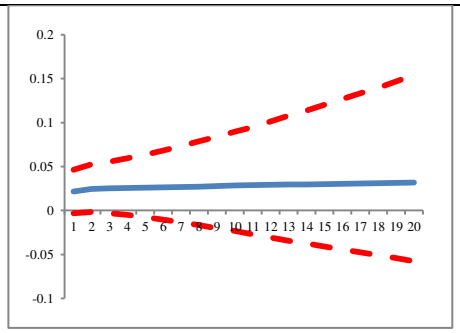
Oil Supply Shock



Global Demand Shock

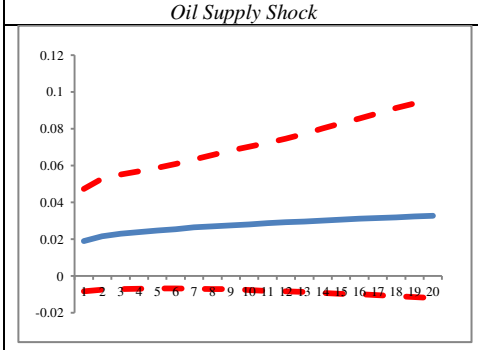


Oil Demand Shock

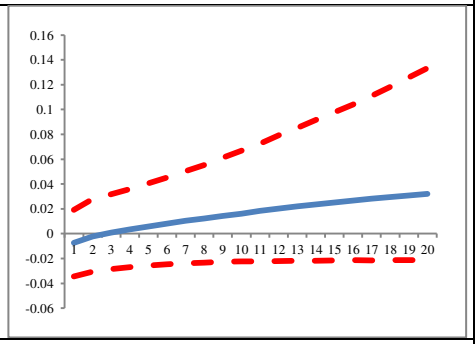


Iran

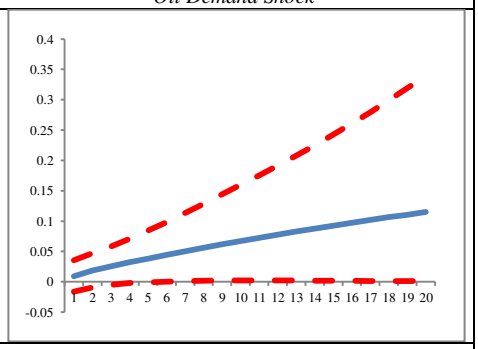
Oil Supply Shock



Global Demand Shock

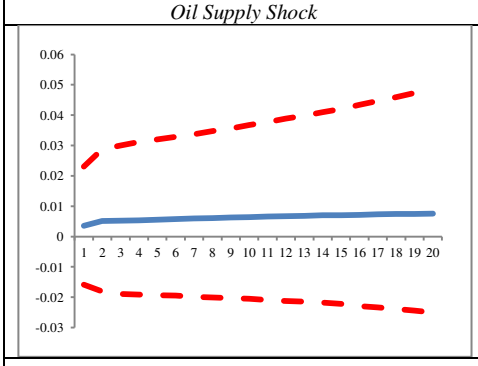


Oil Demand Shock

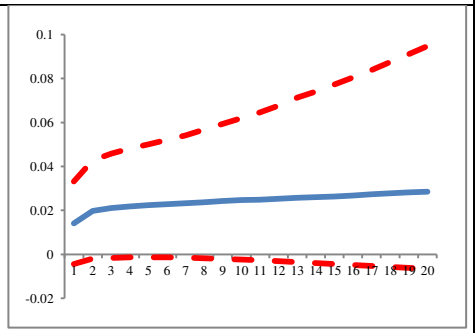


Kazakhstan

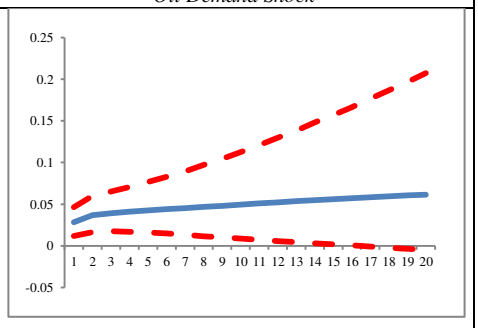
Oil Supply Shock



Global Demand Shock



Oil Demand Shock

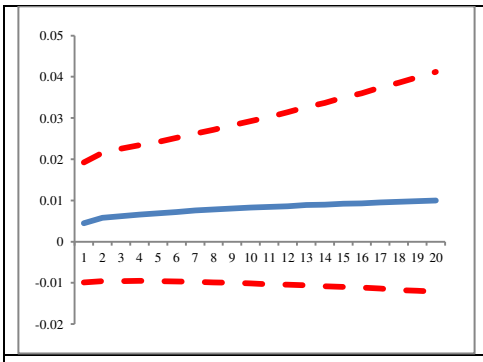


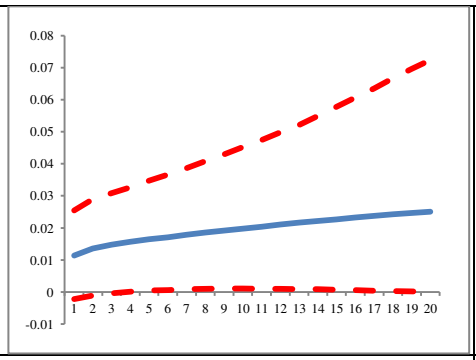
Kuwait

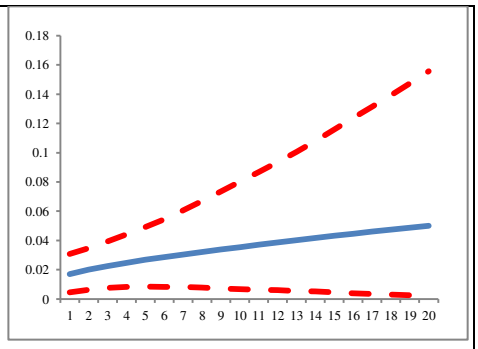
Oil Supply Shock

Global Demand Shock

Oil Demand Shock

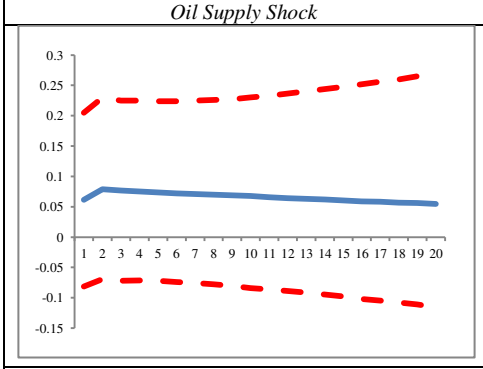




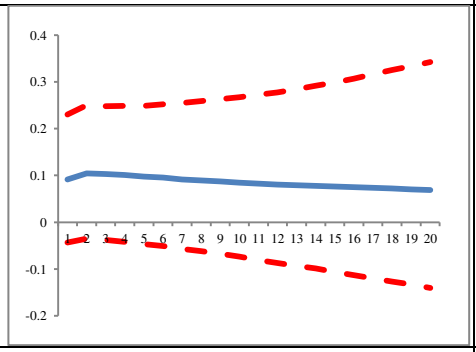


Nigeria

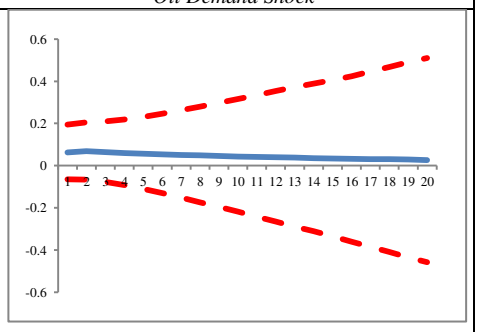
Oil Supply Shock



Global Demand Shock

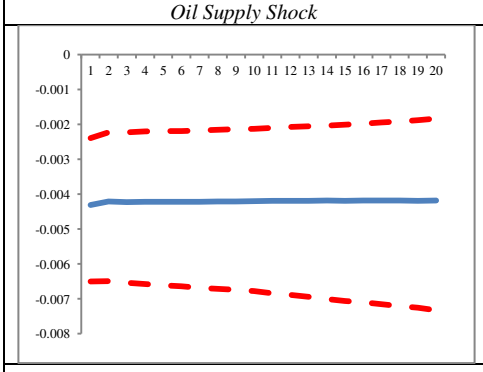


Oil Demand Shock

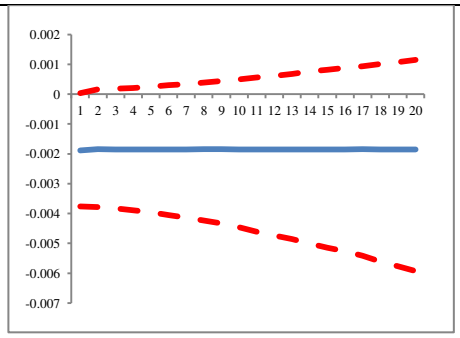


Norway

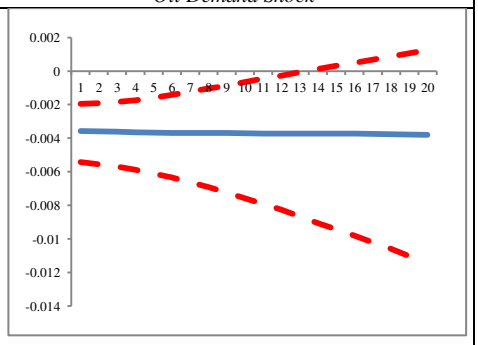
Oil Supply Shock



Global Demand Shock

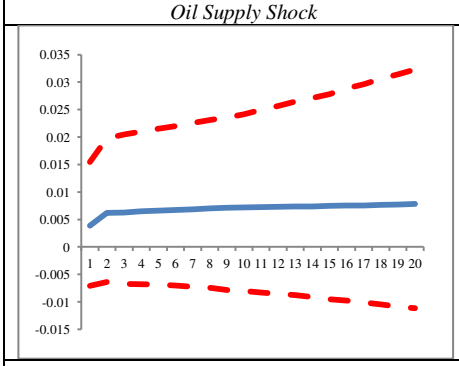


Oil Demand Shock

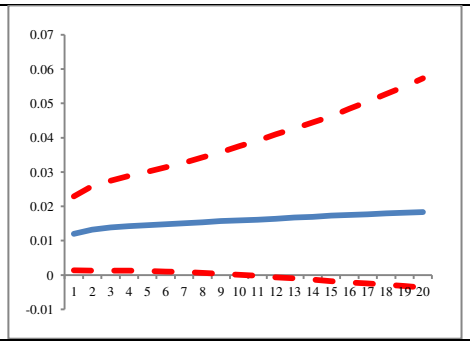


Oman

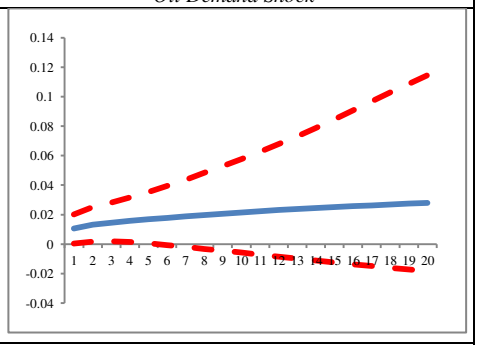
Oil Supply Shock



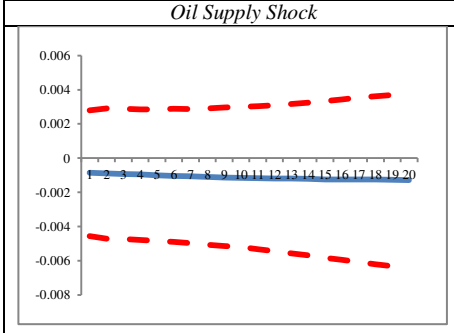
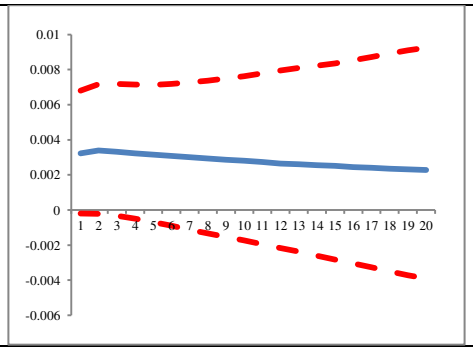
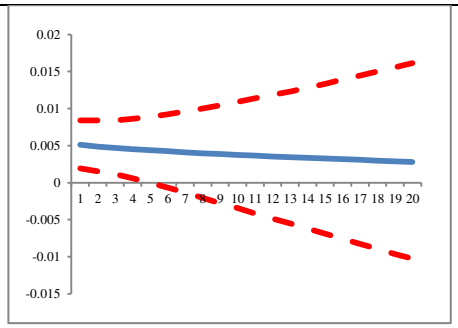
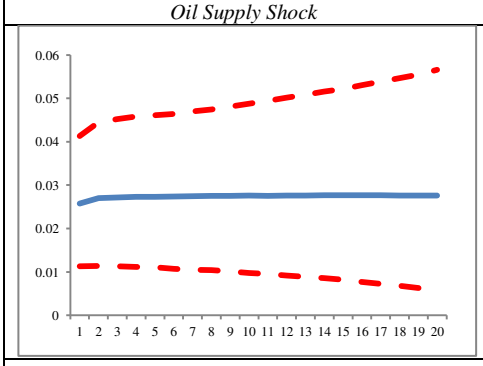
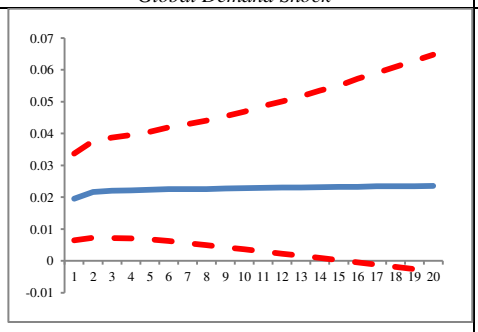
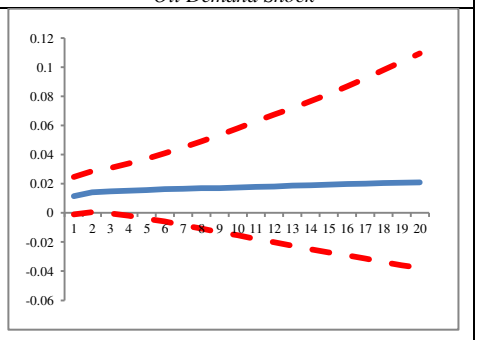
Global Demand Shock



Oil Demand Shock



Russia

Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		
	Saudi Arabia	
Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		
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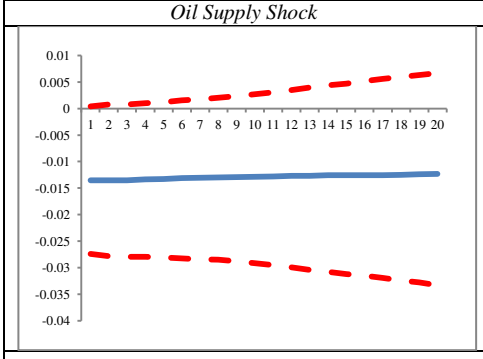
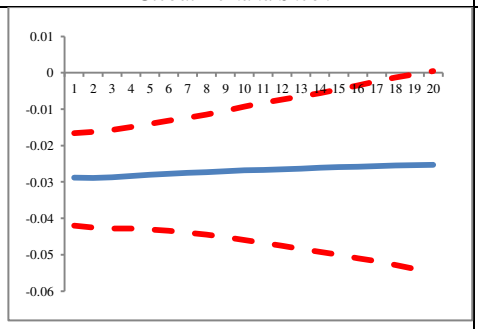
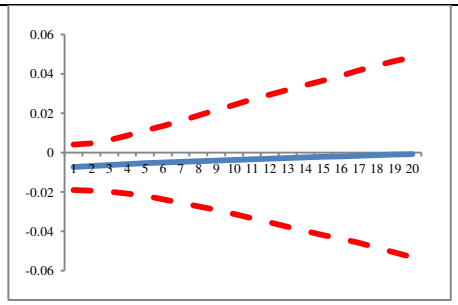
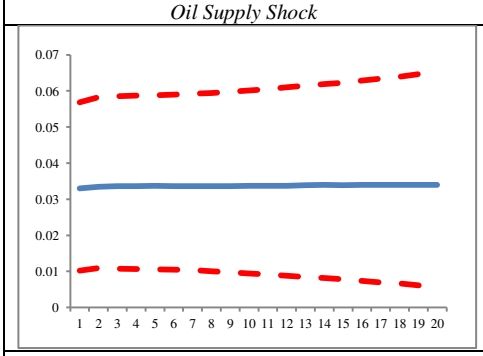
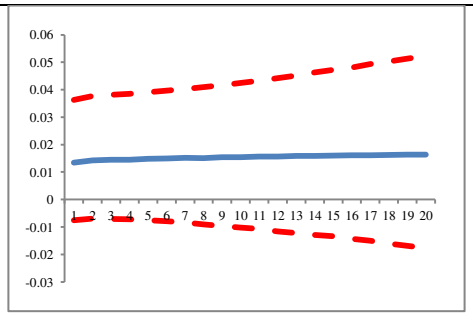
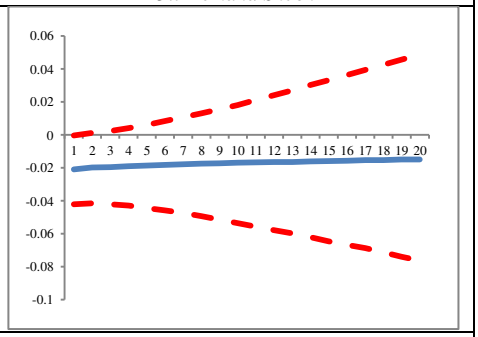
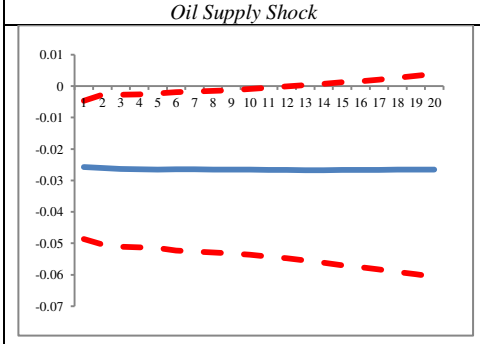
Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		
	Venezuela	
Oil Supply Shock	*Global Demand Shock*	*Oil Demand Shock*
		

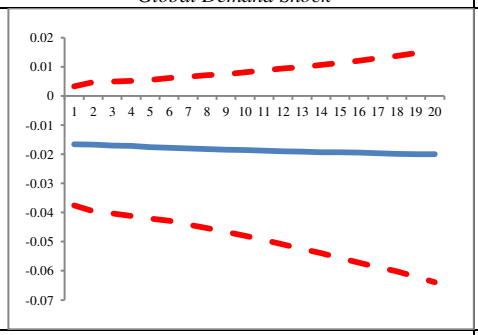
The Investment, 68% CI

Algeria

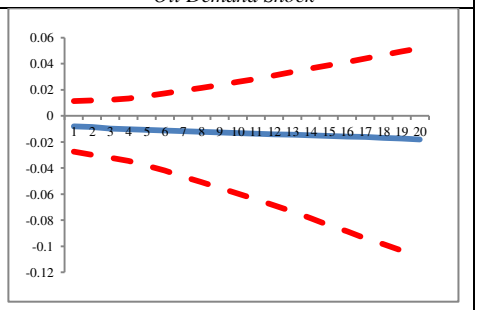
Oil Supply Shock



Global Demand Shock

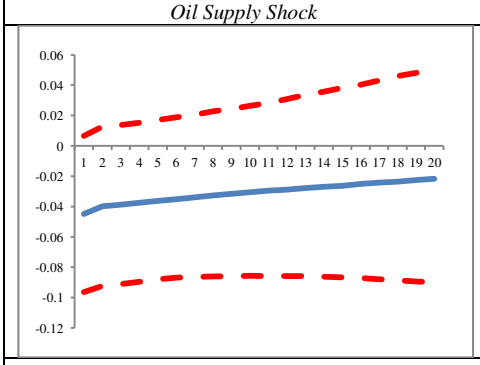


Oil Demand Shock

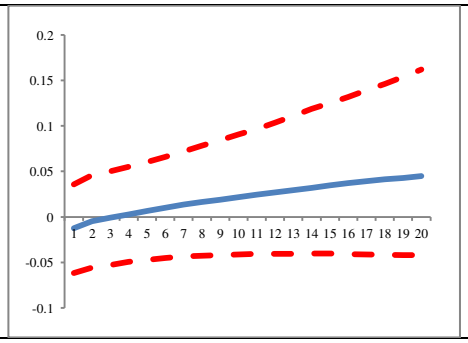


Angola

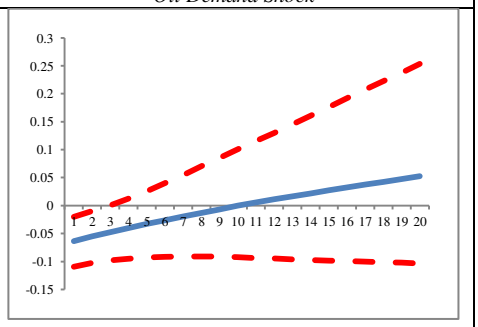
Oil Supply Shock



Global Demand Shock

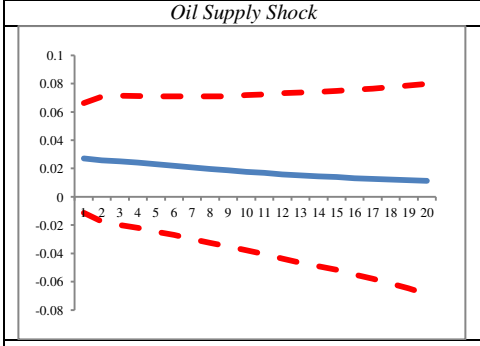


Oil Demand Shock

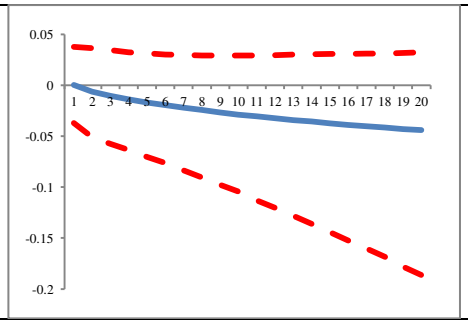


Azerbaijan

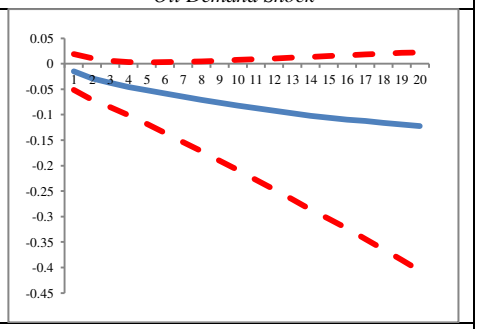
Oil Supply Shock



Global Demand Shock

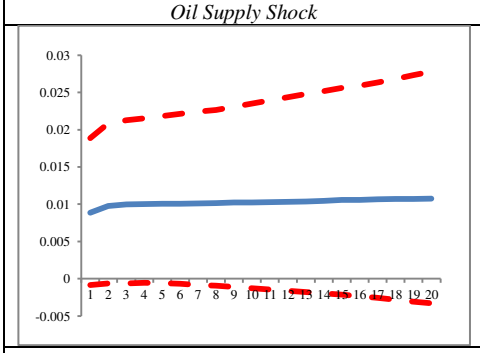


Oil Demand Shock

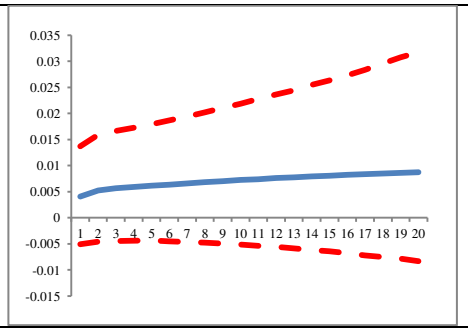


Iran

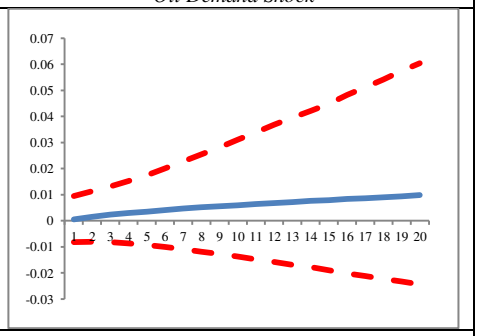
Oil Supply Shock



Global Demand Shock

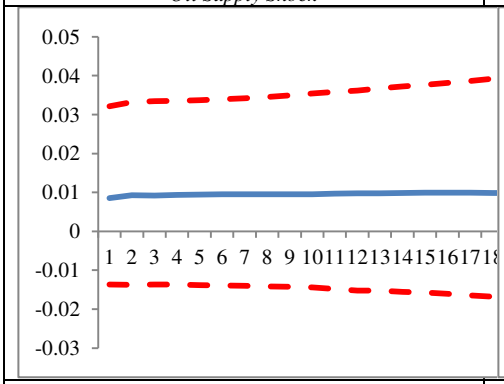


Oil Demand Shock

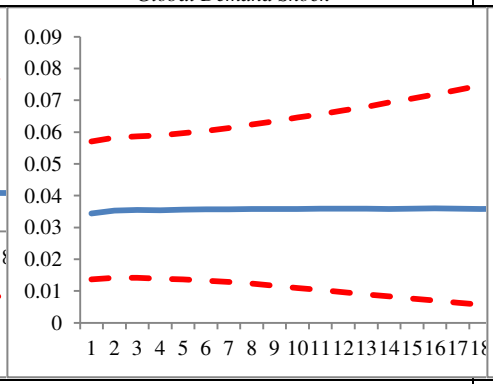


Kazakhstan

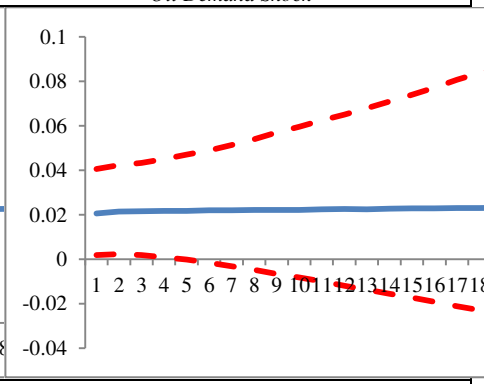
Oil Supply Shock



Global Demand Shock

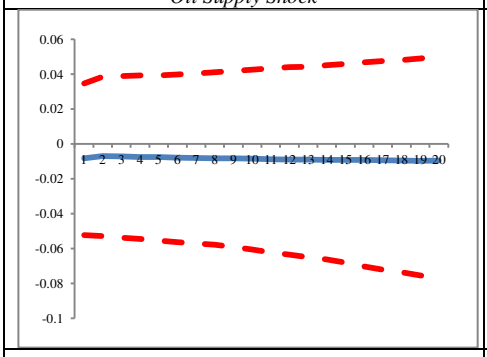


Oil Demand Shock

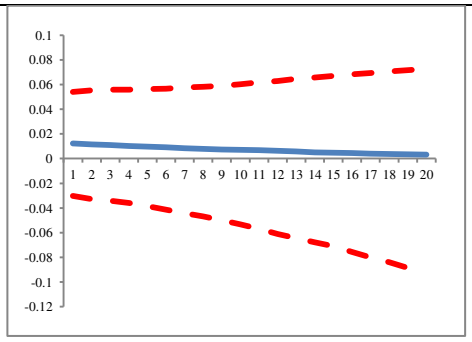


Kuwait

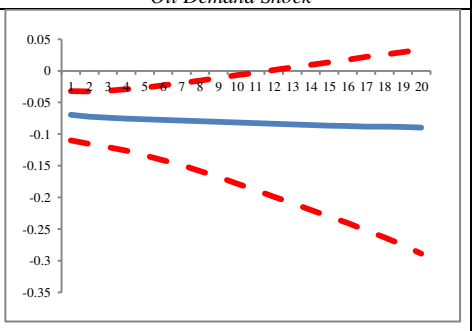
Oil Supply Shock



Global Demand Shock

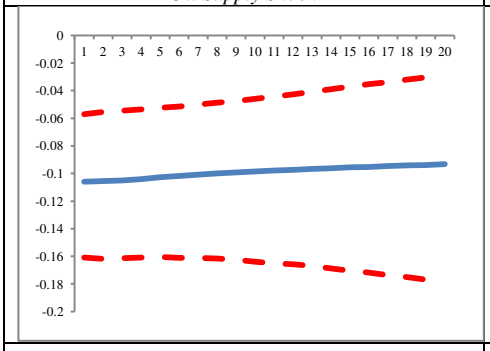


Oil Demand Shock

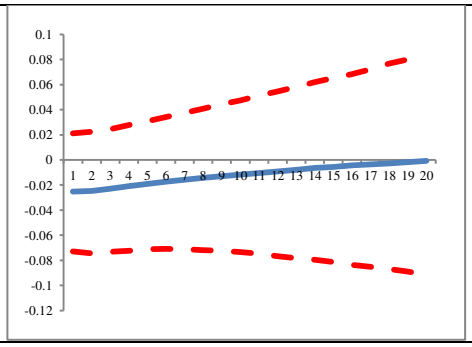


Nigeria

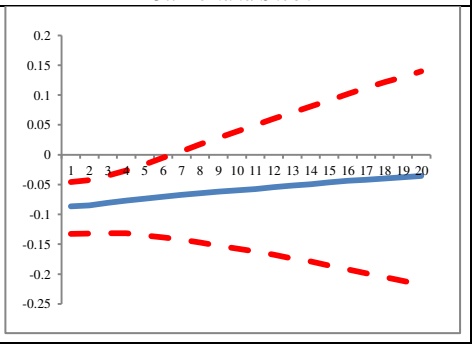
Oil Supply Shock



Global Demand Shock



Oil Demand Shock

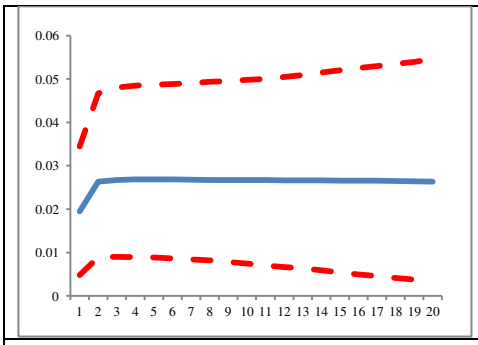


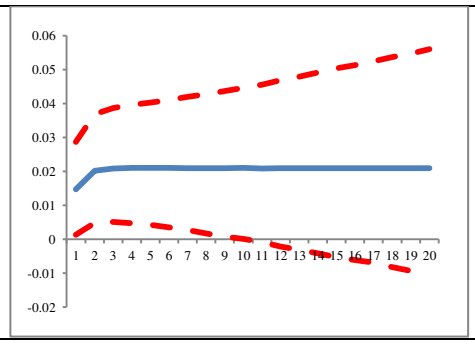
Norway

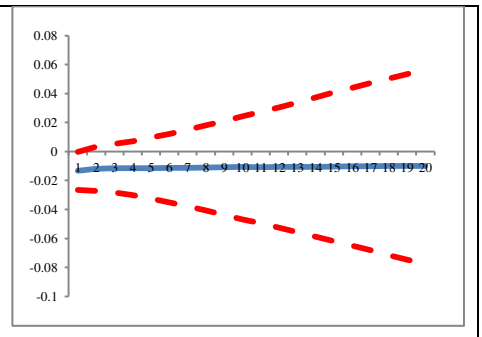
Oil Supply Shock

Global Demand Shock

Oil Demand Shock

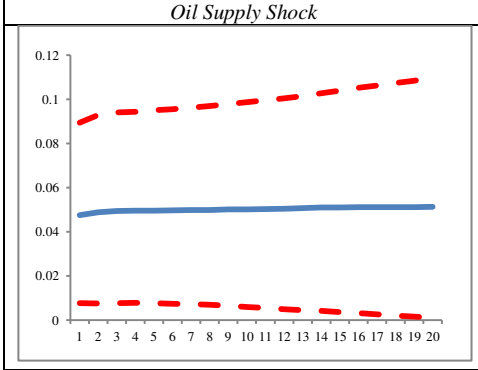




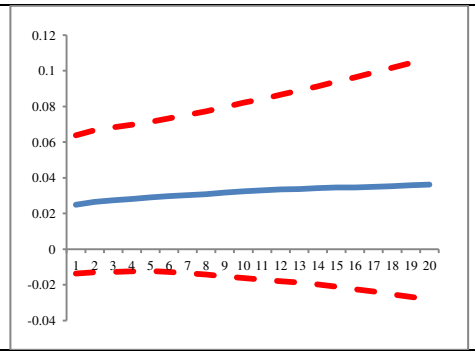


Oman

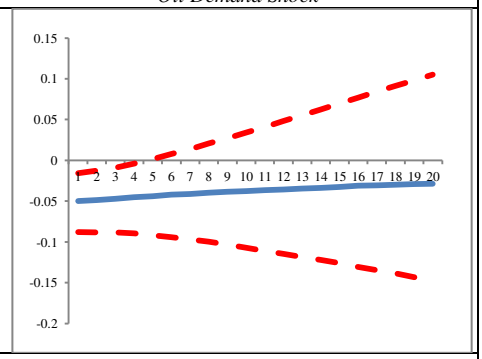
Oil Supply Shock



Global Demand Shock

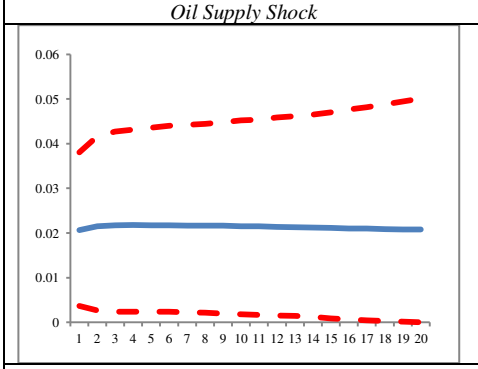


Oil Demand Shock

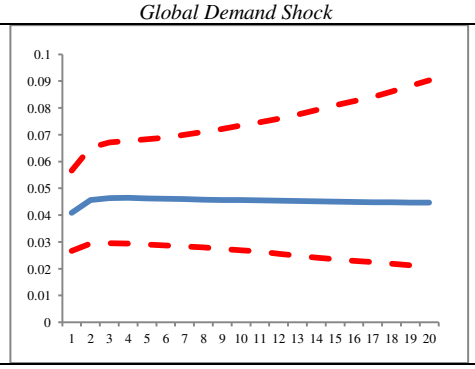


Russia

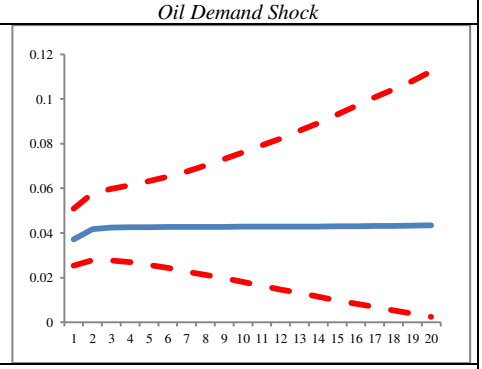
Oil Supply Shock



Global Demand Shock

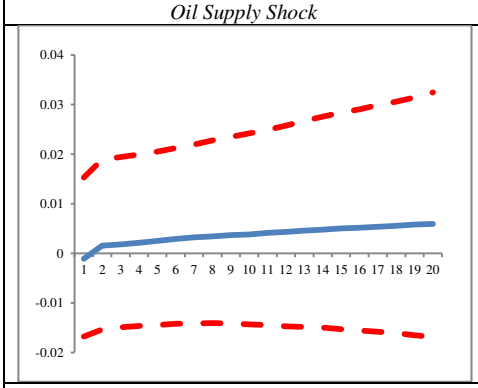


Oil Demand Shock

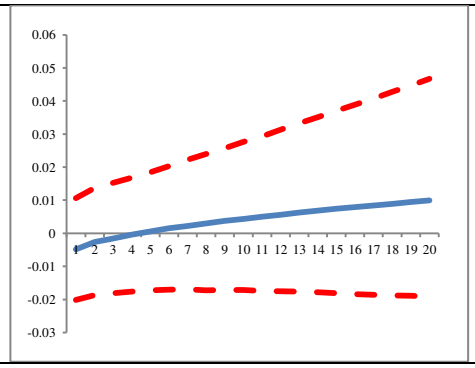


Saudi Arabia

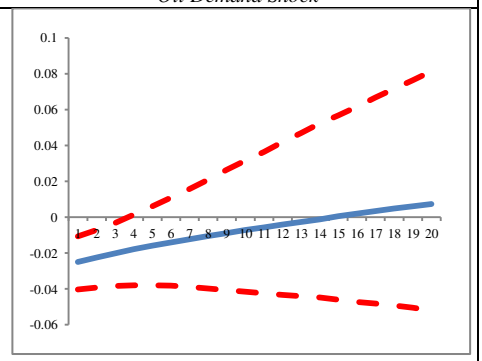
Oil Supply Shock



Global Demand Shock

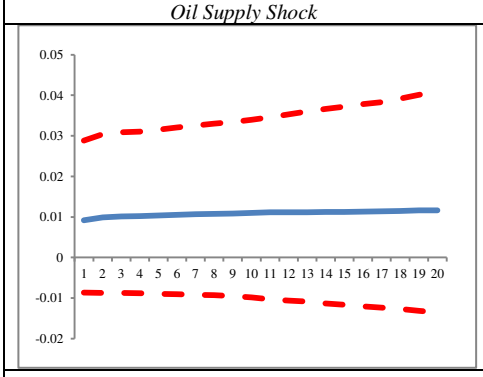


Oil Demand Shock

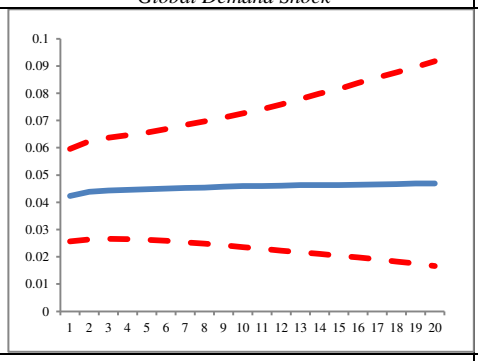


UAE

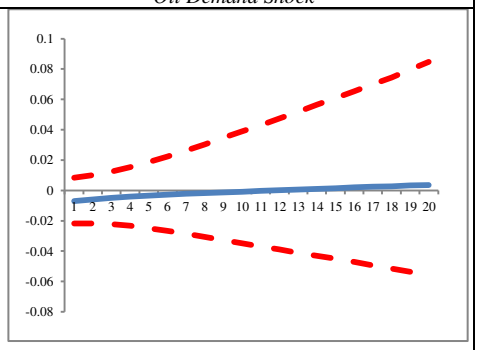
Oil Supply Shock



Global Demand Shock

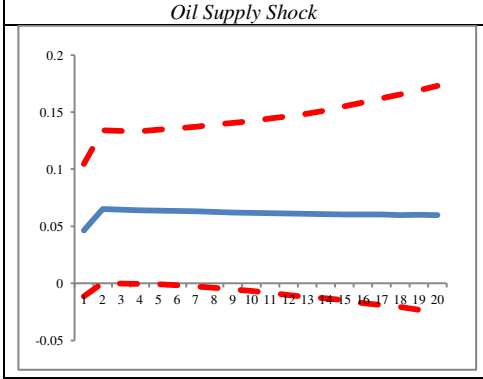


Oil Demand Shock

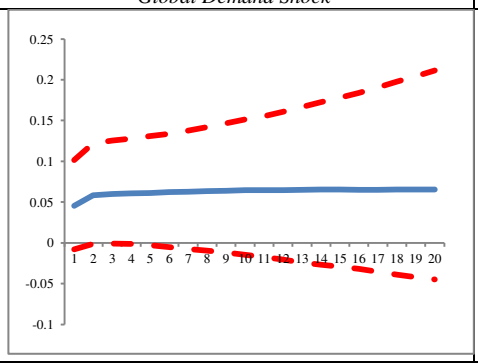


Venezuela

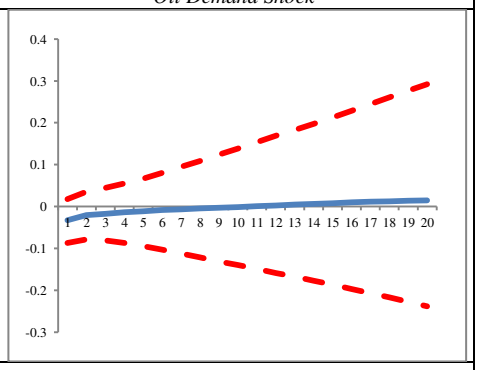
Oil Supply Shock



Global Demand Shock



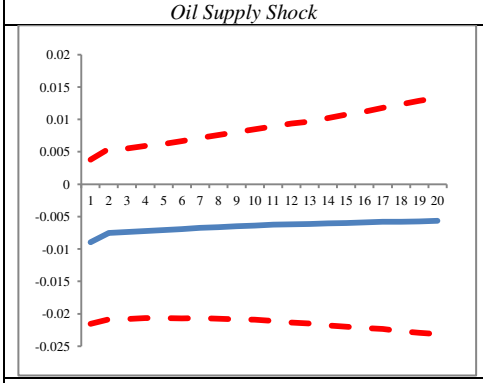
Oil Demand Shock



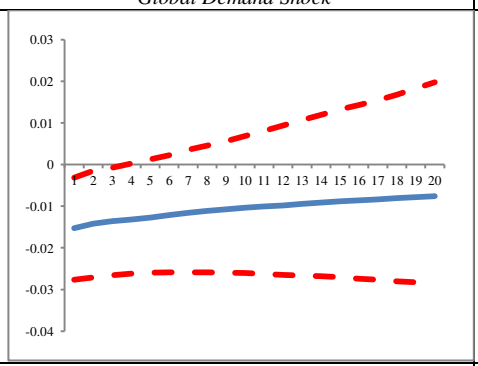
The Imoprt, 68% CI

Algeria

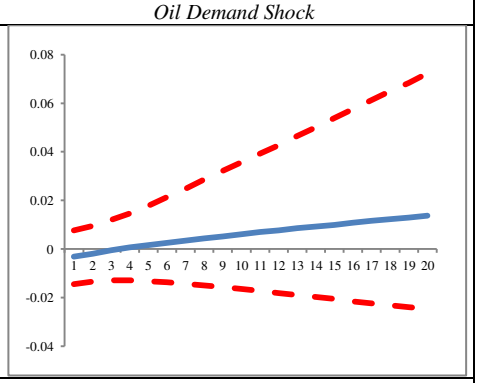
Oil Supply Shock



Global Demand Shock



Oil Demand Shock

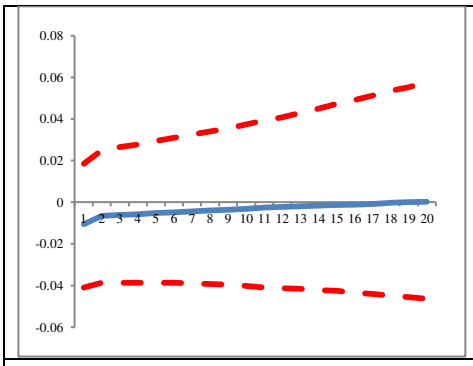


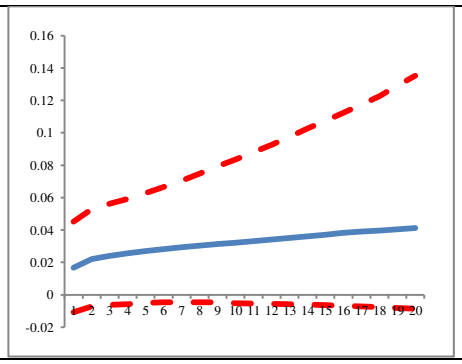
Angola

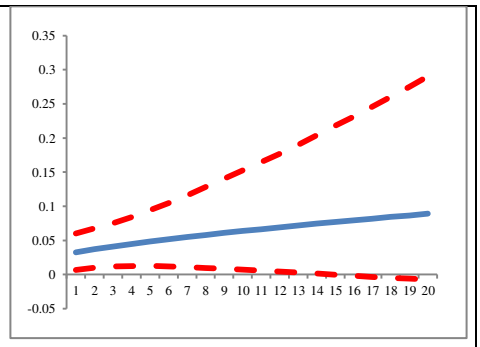
Oil Supply Shock

Global Demand Shock

Oil Demand Shock

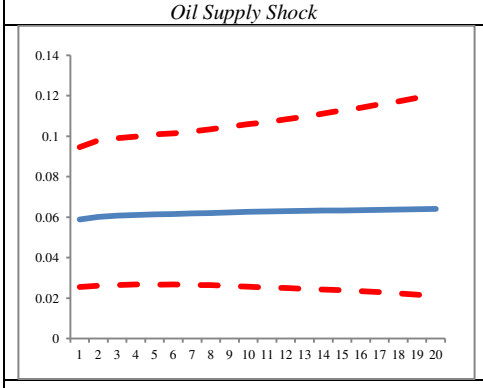




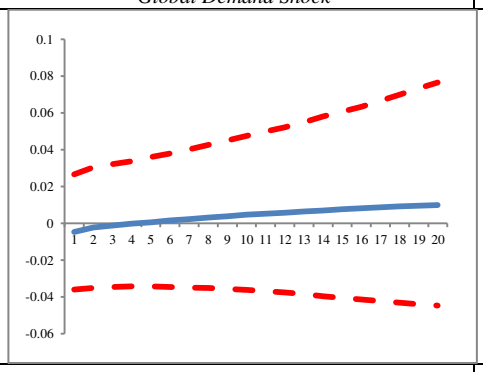


Azerbaijan

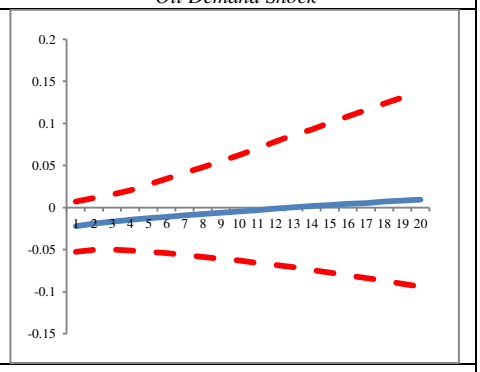
Oil Supply Shock



Global Demand Shock

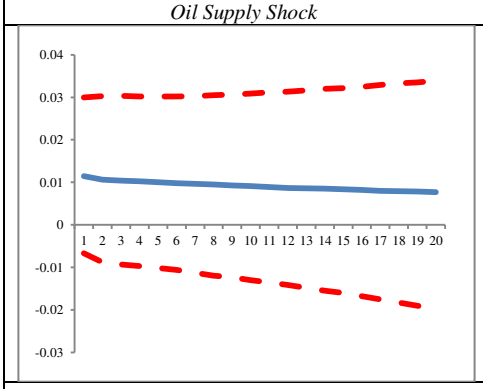


Oil Demand Shock

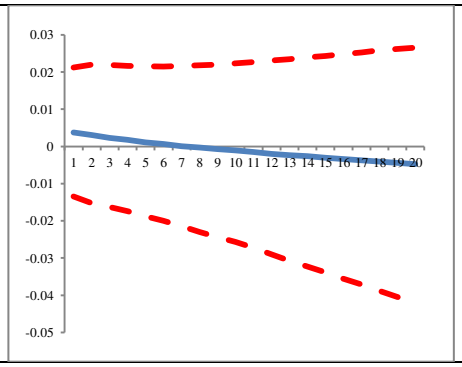


Iran

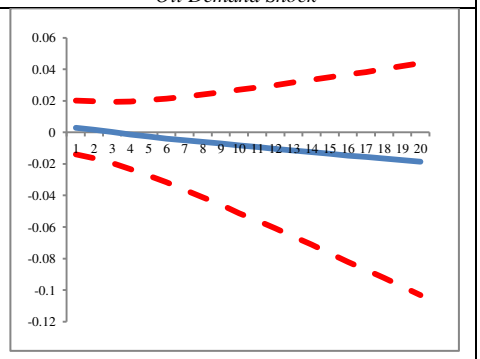
Oil Supply Shock



Global Demand Shock

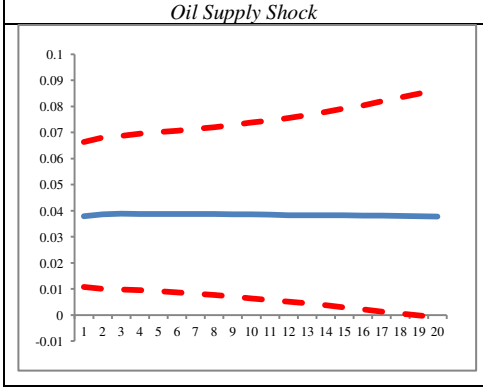


Oil Demand Shock

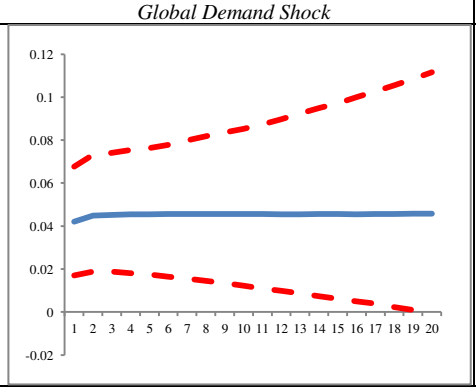


Kazakhstan

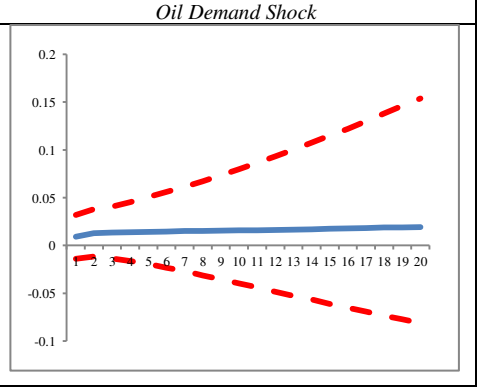
Oil Supply Shock



Global Demand Shock

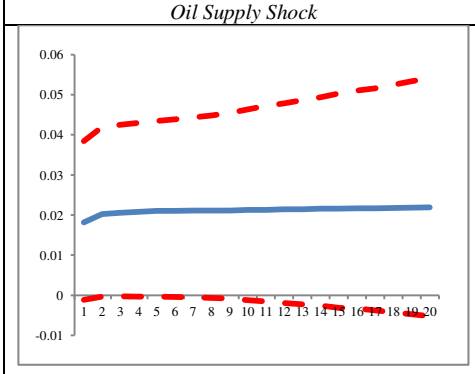


Oil Demand Shock

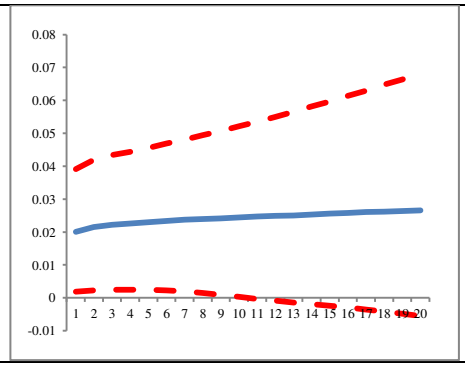


Kuwait

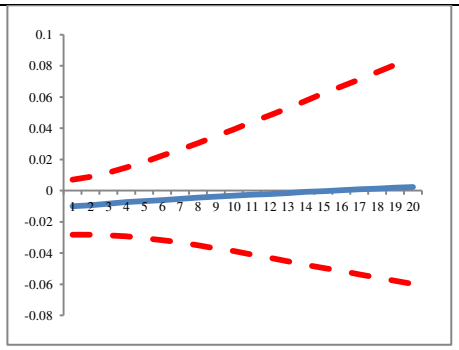
Oil Supply Shock



Global Demand Shock

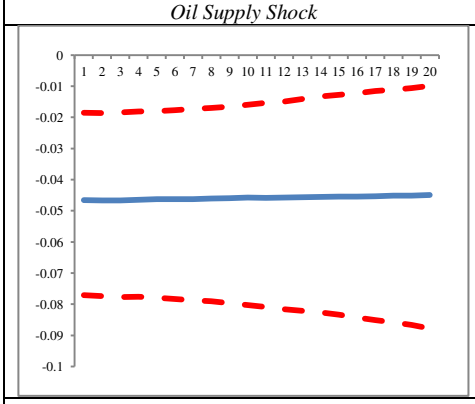


Oil Demand Shock

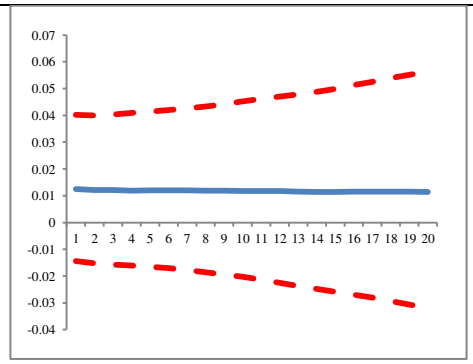


Nigeria

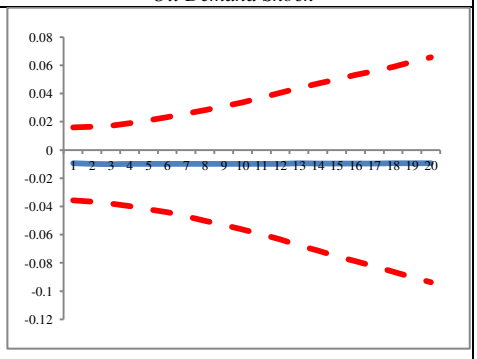
Oil Supply Shock



Global Demand Shock

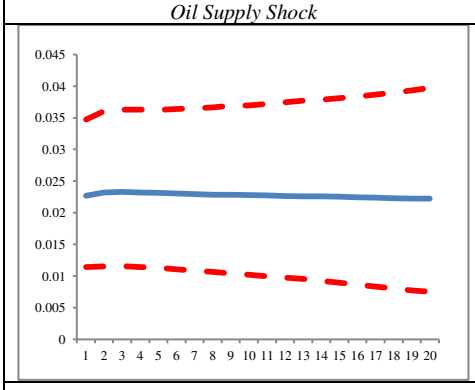


Oil Demand Shock

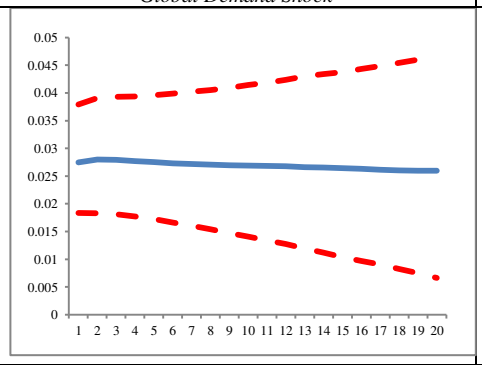


Norway

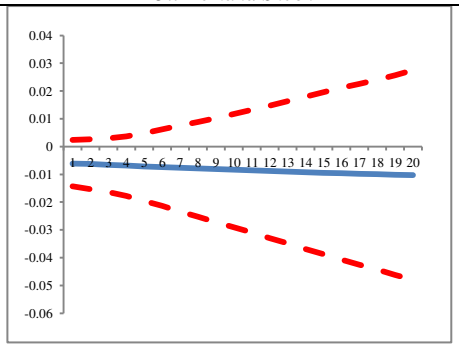
Oil Supply Shock



Global Demand Shock



Oil Demand Shock

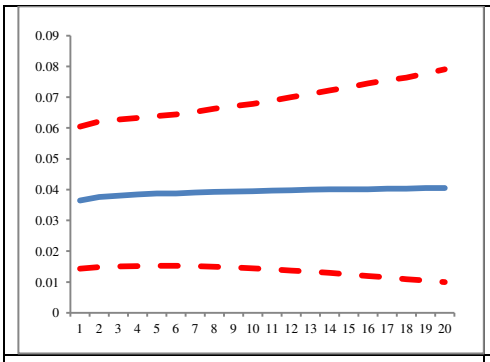


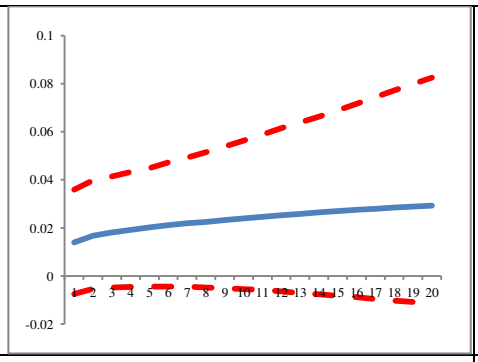
Oman

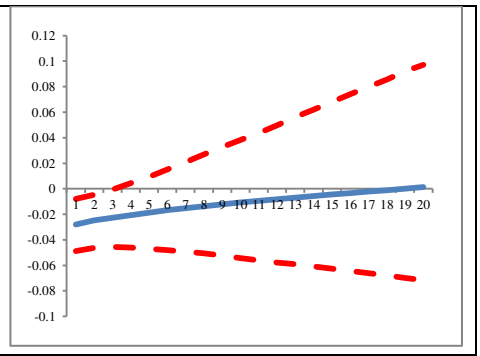
Oil Supply Shock

Global Demand Shock

Oil Demand Shock

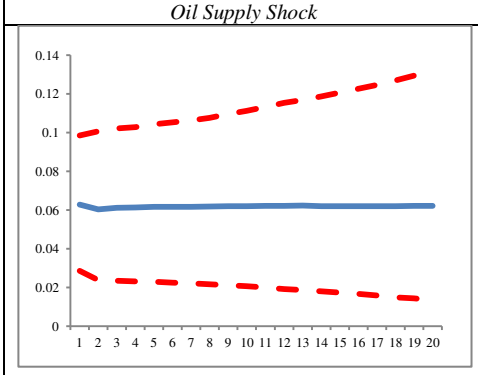


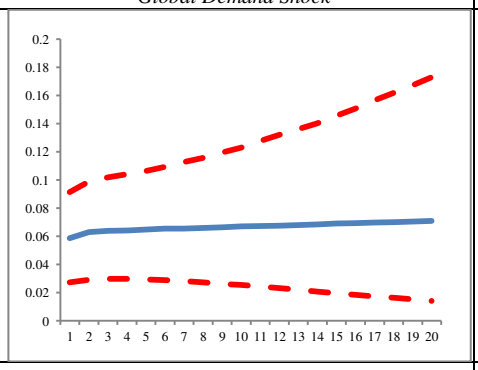


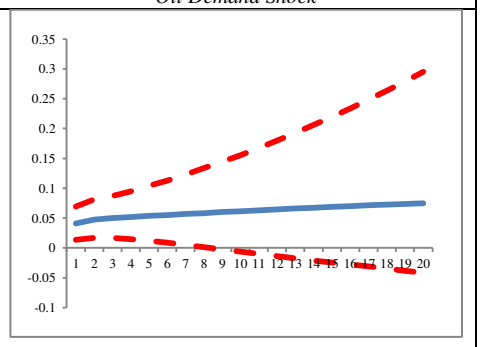


Russia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

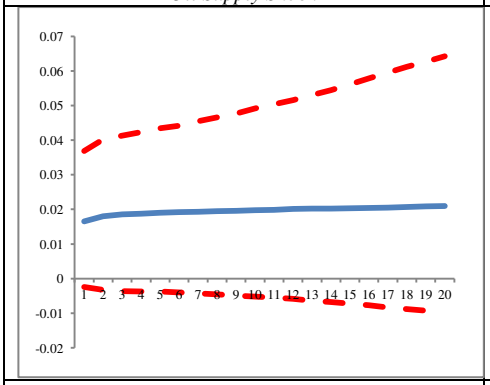


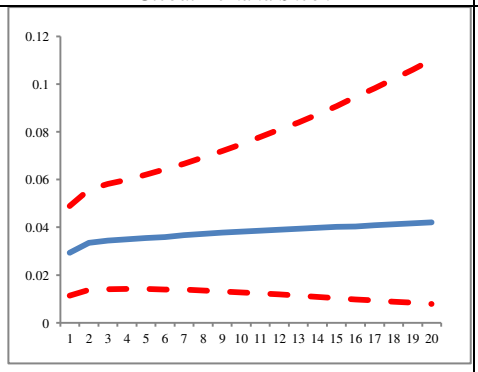


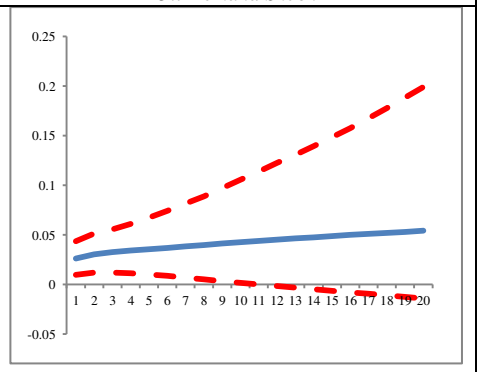


Saudi Arabia

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

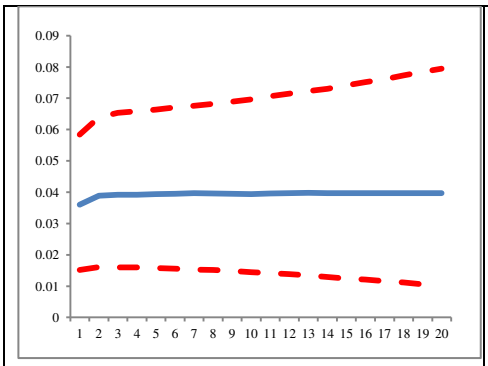


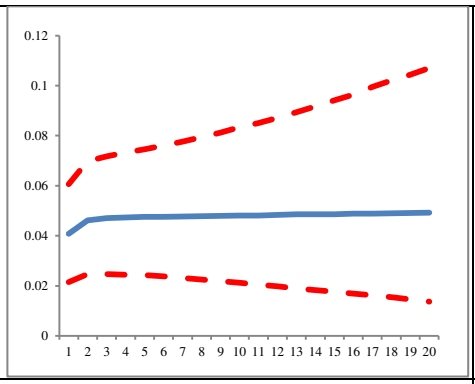


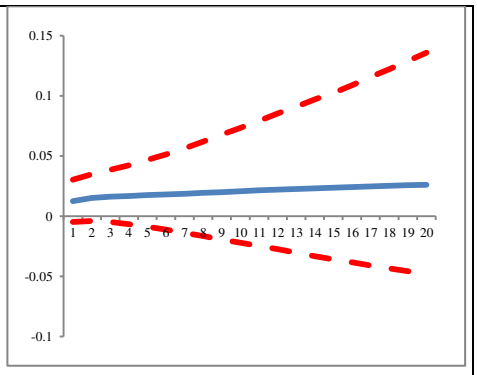


UAE

Oil Supply Shock | *Global Demand Shock* | *Oil Demand Shock*

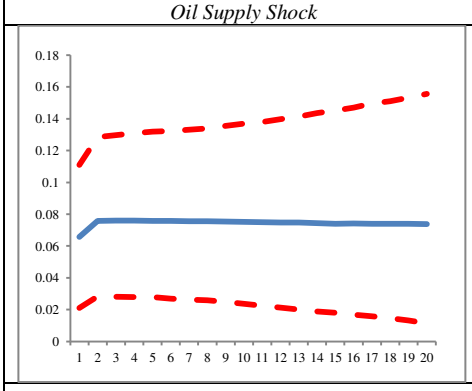




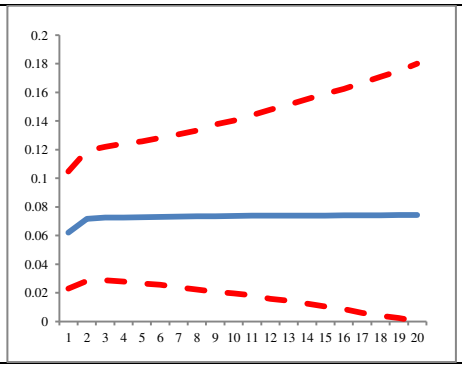
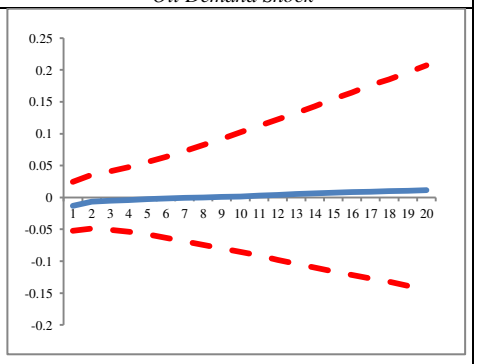


Venezuela

Oil Supply Shock



Global Demand Shock



Oil Demand Shock