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Macroeconomic effects of oil price shocks on the major oil-exporting countries

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INTRODUCTION

Oil plays a substantial role in the world economy; it is the most crucial energy commodity in the world. It remains the primary source of energy accounting for almost a third of global energy production. Despite the change in trends in the energy markets to renewable sources (i.e., wind, solar, water), oil market still holds the biggest share in the energy market. World's energy dependency on crude oil is hard to ignore and it remains significant source of energy. As a result of this, crude oil carries many macroeconomics effects on the global economies for both the oil exporters and oil importers. Meanwhile, the international oil prices are highly volatile and varies far more frequently than any other energy commodity. The unpredictability in the future prices has its own short and long-run impacts for the oil exporting economies. The sudden fluctuation in price has a major impact on the macroeconomic performance of oil exporting countries. It also has direct consequences on currency inflow and foreign exchange reserves of the central bank of any country. Positive oil price shock implies an increase in wealth transfers from oil importing economies to the oil exporting economy. Meanwhile a hike in oil price is a concern for the oil importing countries on their balance of payments and consequently on foreign reserves while vice versa is true for oil exporting countries as large export revenue is collected from sales. The falling oil prices causes an imbalance in trade and the balance of payments, as the foreign reserves start to shrink for heavily oil dependent countries. The national government is the main beneficiary from the oil export, direct revenues, royalty, value added tax and windfall taxes associated with oil production in most of the oil exporting countries. Most of the oil producing companies are mostly state owned in oil exporting economies. So, any downward trend in oil price dramatically affects the government source of income and that effect the government future expenditures to run the country.

Problem statement – the crude oil exports revenue plays a vital role in the annual government budgetary for oil dependent countries. The government decisions on investments and expenditures are massively affected by volatile oil prices. Thus, the problem here to find whether there is a gap if exists to be filled for to play a role of sustaining the growth rate of oil exporting countries despite falling oil price. If there is a gap then how can it be provided by improved economic thinking.

Aim – the aim of this study is to elaborate recommendation for the governments of oil exporting country on how to avoid damages on the fiscal balance structure as a result of dropped oil prices based on the analysis of macroeconomic indicators.

Objective – the paper is investigating the following **objectives** for oil-exporting economies.

- To investigate the impact of oil price fluctuation on oil exporting countries from the previous research findings.
- To study the history of oil pricing, the major shocks in the past and how the price was determined.

- To collect the oil price and macroeconomic data of exporting country, then formulate a methodology to analyze the impact of oil price fluctuations on macroeconomic indicators.
- To classify the oil exporting countries in groups according to the economic status of being developed or developing.
- To analyze the outcomes from the method and compare the trends of oil exporting economies.
- To recommend the policy makers some key solutions from the outcomes of the analysis in order to minimize the damage on the economic growth by oil prices.

Subject – the response of government to the shrinking oil revenues as result of oil price shock.

Object – the major oil exporting countries and the heavily dependent oil economies.

Novelty – the economic analysis of the oil exporting countries' fiscal balance and the widening fiscal deficit as a result of the falling oil price that shrinks the government revenues.

Method used – the SVAR model that includes the fundamental macroeconomic indicators of the economy.

Structure of the paper – the structure of this paper is divided into the following as introduction, four chapters that includes the findings from the previous author, history of oil price, methodology, empirical analysis and the recommendation then finally the conclusion, bibliography and the appendixes.

The first chapter starts right after the introduction and reviews in detail the work of other author's literature work on the oil price and its impact on the economies. The findings from this chapter are helpful for designing, finding the gap and to select the best model for the space in literature that is yet to be filled on this topic. The second chapter takes a look at the history of price, the trends of oil price in the past, who controlled the oil price in past and why oil price was so much impactful on the global economic system. Also, the chapter takes a deep look at the sudden slumps in oil prices and specially the most recent drop in prices and the recovery afterwards that is not covered by previous literature work. The third chapter starts with the methodology with the help from the similar models that is widely adopted and accepted by the authors. Then the macroeconomic indicators that is going to be analyzed are chosen. After deciding that, the main source of data is collected and the time period is decided that fits in the model. Also, for the better understanding and analysis the exporting countries are analyzed in groups as classified by their developed, transitional and developing economic status. The results are assessed in fourth chapter in their classified groups, that consists of the analysis of various macroeconomic indicators as a results of oil price impulse. Then to conclude all the groups are compared to find out the most impactful group of countries to oil price volatility. Furthermore, some recommendations are suggested to implement on the future domestic economic policies for highly dependent oil economies. In conclusion, the paper summarizes all findings that were revealed during the research and suggest the scope for further research.

CHAPTER 1. RESEACH FINDINGS ON OIL PRICE IMPACTS

The previous literatures have extensively reviewed the impact of oil price shocks on the oil-importing countries and its consequence to the macroeconomy by randomly chosen countries. Some papers have worked on the exporting countries as well as their government dependency on the oil revenue. Also, oil price impact on poor countries, the emerging markets and the exchange rate vulnerability as a result of the shock for the selected countries have be discussed by precious workers. This chapter will review the relevant approaches and findings by the authors who worked on the impact of oil prices for various countries.

1.1. Impact on oil importing countries

An examination of the effect of oil price uncertainty on industrial production and the exchange rates in four oil exporting countries, Canada, Mexico, Norway and Russia shows the that oil price uncertainty result in a persistent drop in industrial production and exchange rate depreciates instantly in reaction to the oil price uncertainty shock. But this reaction is long-lasting only in the case of developing countries [Smiech et al., 2020].

An investigation on oil price volatility on industrial production of emerging oil-exporting economies - Brazil, Mexico and thirty-five OECD countries recommends the new emerging oil exporting economies to diversify their economies into non-oil exports for alternate export revenues [Alao, Payaslioglu, 2021].

The adverse effects for oil importers have been studied previously numerous times by authors. One of the research authors collected the data of fifteen biggest oil importing European countries namely Germany, UK, Spain, France, Italy and ten others to study the impact of oil prices on inflation and industrial production. It shows that oil price hikes have permanent effects on inflation but it is short-run, while it has asymmetric effects on production growth rates that is long-term [Cunado, Gracia, 2003].

A study examined the industrial production changes caused by oil price volatility on the US and Canada as oil-importing countries, its outcome also suggests long-term effect on the industrial production as response to shock [Elder, 2009]. The impact of oil price shocks on macroeconomic activities on Malaysian industrial production as an oil importing country is investigated by SVAR approach. The results suggest an impulse response functions show a prolonged dampening effect of oil price volatility shock on Malaysian industrial production. [Ahmed, Wadud, 2011].

Literature work by Gupta assesses the relative oil vulnerability of twenty-six net oil-importing countries for the year 2004 with various economic indicators i.e., ratio of oil imports to GDP, oil consumption per unit of GDP, GDP per capita, oil share in total energy supply, reserves to oil consumption and net oil import dependence etc. The findings reveal that most of the selected economies are highly dependent on oil with oil averaging 37 % for meeting their energy demand.

Few countries have found to have absolutely no crude reserves i.e., Korea, Japan and some European countries, hence they are entirely dependent on oil imports. On the other hand, Australia, China, India and U.S shows the best reserve to consumption ratio in the research, so they were the least vulnerable to hike in oil price compared to other countries in the study [Gupta, 2008].

The impact of high oil prices on low-income and poor countries is examined by UNDP. The evidence is collected from countries such as Pakistan, Iran, Yemen and some other countries indirectly are examined with raw data collection. Results found that the low-income countries are more effected than development nations to oil price hikes as the budget of government gets disturbed and the inflation increases with the increased imported oil price [UNDP, 2007]. The current account deficit widens while the currency devalues and the poor country suffers [Bacon, 2005].

1.2. Impact on oil exporting countries

When the oil prices are high, the government can overspend their revenues for the development in to enhance and invest in the other aspects of the economy. Generally during the oil price slump, many oil exporting countries are unable to cut their government expenses as quickly to meet the falling revenue. That ultimately makes the government to pause the development expenditure in many parts of the economy. The macroeconomic consequences include the widening of the current account balance, fiscal deficit, government debt, foreign reserves, net revenue collection, taxes and GDP growth. Many developing economies are solely dependent on the export revenue collection from oil. As the price falls, it enlarges the current account and fiscal deficits for oil exporting countries and the governments need to borrow debts to run the state affairs.

A study on the oil dependencies of Middle East and North African (MENA) oil producers and the evolution of the MENA economies over the past two decades found that the effects of oil price volatility on oil-exporters have not been considered extensively enough in previous literatures. One of the studies reveal that Iran and Saudi Arabia dominate the highest oil-export revenue. Iran shows least dependency on oil export revenue per unit of GDP. Iran shows the lowest oil export to domestic consumption ratio while Qatar shows the highest oil export to domestic consumption ratio. Qatar economy shows least dependency on oil revenue [Bhattacharyya, Blake, 2010].

One recent paper investigated the oil price impact on exchange rate and macroeconomic fluctuations on a small oil-exporting economy i.e.., Azerbaijan. Results reveal that an oil price decline deteriorates trade balance, increases inflation and results in a currency depreciation on Azerbaijan economy [Yildirim, Arifli, 2021].

The impact of oil price shocks on the economic activities is processed in two ways: fiscal and export channels. Whenever a positive oil price shock takes place, the following macroeconomic activity occurs in the country that makes huge capital inflows. Which then makes an appreciation of the domestic currency. The appreciation makes the price of the imported goods cheaper. So, a positive

oil price shock for oil exporting country will make general price of imported goods cheaper. The other way oil price affect is the increased in government budgetary. As the oil-exporting government makes more revenue, it has a budget surplus from royalties, taxes and export revenues. The government spending increases on public development, which alter the GDP growth in the country [Alekhina, Yoshino, 2018].

ADBI (Asian Development Bank Institute) published a report on the impact of oil prices on an energy exporting economy. It investigated the oil exporting country's relationship between international oil prices and macroeconomic indicators by using VAR approach. According to the report the previous research work on oil price shocks were mainly focus on the advanced economies, especially for the oil-importers. The ADBI report investigated the non-OPEC countries and the results show that the hiked oil price increase the GDP growth, decreases inflation, decrease interest rate, and cause exchange rate appreciation for oil exporting economies [Alekhina, Yoshino, 2018].

European commission published a report on the vulnerability of oil exporters to lower oil price during the period of 2014-16. The findings reveal political stability in the oil market is a key importance along with the government revenue. The macroeconomic impacts on the exports in the countries of Sub-Sahara Africa, Middle East, Asian, South American and Oceanic countries and its analysis on oil price volatility reaction to the GDP and consumption of net crude exports. Results indicates several Sub-Saharan African and North African countries show high exposure of the economy to the oil market. The high dependency of government budget to oil price makes these exposed countries very vulnerable to price slumps. [Kitous et al., 2016].

One author published a paper on Central Asian oil exporting countries i.e., Kazakhstan, Azerbaijan, Turkmenistan and Uzbekistan. The results shows that 80 % of all export revenues are generated by energy sector. Kazakhstan's exports of oil and natural gas accounts for 67 % of their total merchandise exports. After the price collapse of 2014, the total exports of Kazakhstan fell to half in 2015 as a result it, additionally it deteriorates the current account balance and increased the inflation. After the exchange rate devaluation, the exports dropped from $62.7 billion to $36.4 billion that is contributed by the low oil exports revenue and ruble depreciation. Around 90.9 % of Azerbaijan's exports revenue comes from crude oil and its by-products, crude oil exports revenue dropped by 52 % after the oil price collapse of 2014. Large dependence on revenues from natural mineral and dollarized foreign exchange market were key vulnerabilities for Azerbaijan economy. [Aleksandrova, 2016].

The oil price uncertainty effects on the output growth of sixteen selected MENA economies is assessed by authors that shows the output into the global market is small enough not to affect the global oil prices. It shows that rising oil price has positive impact on the economic growth of net-oil exporting countries i.e., Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Syria, and the U.A.E. But,

no significant economic growth was found as a result of rising oil price on the economies of Bahrain, Djibouti, Egypt, Israel, Jordan, Morocco, and Tunisia [Berument et al., 2010].

1.3. Uncertainty in oil prices

Although no research literature has found the sole reason for the uncertainty in oil prices. But there are several factors that plays important role in declining oil prices. First factor is the global oil production being more than the actual demand in other words the oversupplying of crude oil into the energy market. In fact, the price crash in 2014 was a direct consequence of the substantial increase in US oil production from 2011 onward until 2015. When U.S surpassed Russia and Saudi Arabia to become the top producer of crude oil in the world. This made U.S independent for its oil crude oil demand as the production from the shale oil met its domestic demand.

Similarly, the conflict or disagreement between the OPEC members and non-OPEC countries can make an oversupply of crude oil into the market more than the required global demand. That results in weakening oil price. Secondly, a weaker economic growth in the emerging Asian markets and lower than expected demand for oil also results in oil price drops. Since, the demand can only be estimated, there is no proper way to accurately predict the future oil demand and hence its price for future. One more factor that plays important role in oil price fluctuations is the US dollar exchange rate, as it the main currency for the trade of oil globally. Strengthening USD affects the emerging economies.

Many authors have agreed that changing USD exchange rate can lead to a global oil price fluctuation. The increase in USD makes the crude price rise in the international market as it becomes expensive to borrow the crude oil to meet the energy demand for emerging economies. Since oil is traded in USD, a stronger dollar will force oil price to fall. The strong dollar along with a slowing global economy are one of many reasons for falling oil prices in international market. The unpredictability of demand supply and the exchange rate fluctuation makes it impossible to predict the future oil prices. But one thing is certain that despite the global shift to green energy, the growing economies of the emerging markets are expected to increase the crude oil consumption due to the increasing vehicles sales and the domestic industrial energy demand [Baumeister, Kilian, 2016; Arezki, Blanchard, 2014].

The 2020 pandemic dropped the oil price to new low for short time period but in long-run the price was expected to rise as the global economy were recovering and industrial production was going back to normal at pre-COVID time. As the demand for oil is the main cause of price dip, the stability in the economies of the global coupled with the OPEC production cuts will make the price to rise when the market is will go back to normal due to the global oil demand [Thai-Ha et al., 2021].

1.4. Impact on other economic aspects

A recent published paper has investigated the impact of oil price shocks on GCC (Gulf Countries, i.e., Saudi Arabia, U.A.E, Oman, Qatar, Kuwait, Bahrain) stock markets. The author found that the GCC stock markets are closely related with the oil prices and their volatile to price changes. The GCC stock market reacts negative to an increase in oil price uncertainty. Kuwait and Qatar showed highest variation to OIV (Oil Volatility Index) and the oil price shocks while Oman and Bahrain showed the least dependency on oil price fluctuations among the GCC members [Alqahtani et al., 2019].

A study on Canadian economy is also been studied as an oil exporting country. The authors investigated the impact of oil price shock on the Canadian economy and the US monetary policies response. Author used DSGE model that incorporates demand and supply of oil while allowing for interaction between domestic and foreign monetary policy. The domestic monetary policy accounts for 40 % variance in domestic outputs. While foreign U.S polices is of lesser importance in propagating oil price shocks on an oil-exporting economy through the international channel. [Delpachitra et al., 2020].

The studies on resource curse finds that the countries with the most natural resources are high priced economies. The consumption from imports does not balance the increased exports of the natural resources [Davis et al., 2003]. Instead of developing the overall economies, the resourced countries orientate to be more and more rely on import led products and they do not diversify and invest in other aspect of their economy [Sachs, Warner, 2001].

The impact of oil price changes on economic growth in Saudi Arabia and its crude oil dependency on the oil to GDP relationship is examined by the author which recommends transforming the economy and opening its equity market [Jawadi, Ftiti, 2019].

There are policy implications by authors for reducing the costs of volatility. The trade policy proposed the fiscal and debt management policy by the categories of countries in three following ways: naturally specialized, inefficiently specialized and not specialized at all [Hausmann, Rigobon, 2002].

The effects of oil price shocks on the business cycle and consumer prices have also been studied by previous authors. The results confirm a demand shock of oil has strong impacts on the real price of oil and the CPI (Consumer Price Index). The outcomes are alike for European countries as well as the U.S but have alike macroeconomic impact on Chinese economy [Herwartza, Plödt, 2016].

1.5. Summary from the findings

The above findings discussed the oil prices impact on stock market, exchange rate depreciation of emerging economies which are mostly oil. Similarly, some literature work on resource course, vulnerability of oil importing countries to high oil prices, the macroeconomic effect oil price on the

industrial production while some work on the oil exporters has been made as well in past that considered the effects of volatility of oil price on the stock market, currency fluctuations and geopolitical reasons. But the literature is largely silent on some issues, as the macroeconomic effect of oil price shocks on the oil-exporters have not been considered for the major oil exporters instead a special attention is given to one particular country or only a set of few oil exporters. Furthermore, the studies have not investigated the oil price slump after the COVID pandemic for the oil exporting economies that caused shrink the demand for the crude oil. This paper will investigate the adverse effect of the pandemic and correlate the data from previous oil price shocks to find if the pattern of damage to the producers is alike.

CHAPTER 2. HISTORY OF OIL PRICE

Oil has been in used from thousands of years. Early human found the oil from the shallow reservoirs through seepage. It was not until the 1859 when Drake drilled the first successful oil well with purpose of finding oil from the subsurface [Devold, 2013]. Since then, oil has been traded and used for commercial purposes. During the time of exponential industrial growth, the oil demand continued to increase dramatically that spiked the oil prices. Also, it is in favor of the oil explorers to have high oil price, in order to invest more in the technology and resources which would not be possible during low oil price time. Oil price of a $100 per barrel or above allows difficult accessed sources to become economically viable. That includes tar sands in Venezuela and Canada, shale oil and gas in the United States, coal bed methane from natural gas etc., that have seen a big jump in their production due to high oil price in the 21st century. Such unconventional sources have triple the reserves of the current conventional reserve of hydrocarbons. More discussion for the past oil price history and the historical price slumps are reviewed in the sub-sections of this chapter below in detail.

2.1. The “seven sisters”, OPEC and current oil price mechanism

The oil market before 1970s was decided by number of international oil companies, called the “seven sisters”. These seven companies were the most powerful symbol of the oil industry of that time. They included five Americans, one Anglo-Dutch and one British company. That included the Standard Oil of New Jersey (later Exxon), Standard Oil Company of New York (later Mobil), the Anglo-Iranian Oil Company (now British Petroleum), Standard Oil of California (now Chevron), Gulf Oil (Later Chevron), Texaco (later merged into Chevron) and Royal Dutch Shell. It is noted that Exxon and Mobil later went on to merge and form ExxonMobil in 1998. There were other companies as well that had some regional control, but the majority of oil business were hold by these seven giants. These companies were vertically integrated company, as a result they did not only control the production of oil, but also the reserves, exploration, drilling, production, distribution and marketing of the oil industry. Their power was integrated from upstream to the downstream refinery channel. They also had their own tankers ship for the transportation of oil that operated from the producing region to the refineries and then to the petrol pump stations [Sampson, 1975]. There was a competition within the group, but the purpose was to nullify the competition internationally and control oil price with absolute powers. While with this much power the companies decide the price of crude oil. It was favorable for the growing western economies to keep the oil price lower to dominate other economies. The American companies starts to find reserves outside of the U.S, as the domestic production starts become a concern for the future oil supply. All the massive reserves of hydrocarbons of the present time in South America, Middle East and North Africa were primarily discovered, explored and developed by the “seven sisters”.

During the 1960s, while the “seven sisters” were still controlling the majority of market share. There was steep decline in the domestic U.S oil production as the U.S was becoming a net importer of oil and the U.S economy was no longer independent on its domestic supply. The “seven-sister” made oil price cuts without the concerns of the producers in the Middle East, this disturbed a balance of payments issue for many oil producers as the “seven sisters” starts to lose their dominance for their dependency on the foreign Middle Eastern oil. Five oil exporting countries met in Bagdad, Iraq and formed a new group named the OPEC (Organization of the Petroleum Exporting Countries) on Sept, 1960. And they invited any countries that is willing to join the group that is the net crude oil exporter. The founding five countries OPEC were Iran, Iraq, Saudi Arabia, Kuwait, and Venezuela. The objective of OPEC group was to make stability in the oil price, while also showing their strength to the western economies. Initially the OPEC had little impact on deciding the oil price, but as there was a new contract agreed between the “seven sisters” and the Middle Eastern producers for a 50-50 profit share deal. When the producers from Venezuela and Indonesia joined OPEC, this becomes an advantage for OPEC group over the international companies. The true power of OPEC group was shown during the Arab-Israel conflict of the Arab oil embargo. The U.S became concern as the price of oil was hiking due to lack of supply from the region. The “seven sisters” lost the ground, as now they had to pay over 80 % of their profits to the governments in tax and royalty [Brew, 2019]. During the 1970s, the control of power over oil pricing had shift from the “seven sisters” to OPEC. The immense increase in demand of oil was fueled by the sale of the automotive industry as it reached an astonishing 2.5 billion cars sales in 1970.

After the oil collapse in 1986, the price mechanism again shifted. But this time from OPEC to the open market as it was decided that oil price would be determined by the supply and demand of crude in to the open market. After the establishment of the international market and some recent developments in information technology have extended the power of the financial markets. The commodities in future markets are increasingly taking the advantage of financial products. The oil price now is a combination of supply, demand and the political situation of the regionals. Although OPEC can determine the long-term control over the oil price as it has about 72 % of the world proven reserves and account for 41 % world crude oil production daily [Oil market report, 2018]. OPEC members also hold the largest world crude capacity of spare oil produced. So, the difference in supply and demand from non-OPEC sources is adjusted by the OPEC members [Petroleum marketing report, 2021].

When the oil price is generally discussed, they are referred to a specific type of crude oil benchmark, that is traded internationally. The crude oil is classified on a benchmark scale, as the crude oil located in any part of the world has different characteristics depending on the sulphur content, API gravity and viscosity. To make it easier for the buyer and sellers the benchmarks is a

vital tool and it is associate with crude oil. It is very relevant for the refineries, as most refineries can only process a certain crude benchmark. The two most popular benchmarks are Brent and WTI (West Texas Intermediate). Brent crude oil price is the benchmark for European and Middle Eastern. WTI is a benchmark crude for Northern America region. While, brent is traded on the ICE (Intercontinental Exchange) and WTI is traded on the CME Group. The prices are determined in the open market during the trading, hence both benchmarks are priced differently [Leonard et al., 2019]

OPEC sets a quota for each member to manage the oil production supply and it handles the future oil price by forecasting the demand. But the biggest factor that can influence the price uncertainty is the demand from the emerging markets. The growing economies demand more and they are more energy dependent on oil than developed countries. In order to review the oil price trends in more details, the past oil price slumps and the aftershocks must be studied. Also, what could have been the cause of oil price shocks in the past for the better understanding of the reader.

2.2. The historical oil price shocks

The oil price has been a rollercoaster in the past five decades. There are hikes and drips in price as a result of various incidence since the early 1970s. The first of the major shock to oil price happen after the Arab oil embargo. The Middle Eastern oil exporters on Oct, 1973 imposed a cessation of oil shipments to the U.S. and other major economies for the affiliation and support by western economies to Israel during the Arab-Israel conflict [Mitchell, 2010]. This Arab oil embargo raised the first modern day oil crisis. This embargo was initiated by Qatar and later on was applied by all Arab countries including Saudi Arabia, Kuwait, Algeria, Libya, Egypt, Abu Dhabi and Bahrain. The Arabs classified their oil export partners into three following categories: friendly, neutral and supporters of Israel. It was clear from the strategy that Arab's policy was very aggressive during this conflict [Zakariah, 2011]. The reaction to this led to the shortage of oil supply. And within months the oil price quadrupled from $3/bbl to $12/bbl until 1974. However, the cessation was lifted after 6 months in March 1974 after negotiations at an oil summit in Washington was held. But the shock reaction remained throughout the 1970s. The economies of the Western Europe, U.S. and Japan were the hardest hit, because their economies were booming in the early 1960s due to low oil price. But this hiked price was proven to a blessing in disguise, as earlier, the prices were too low to encourage the exploration of new reserves and invest in more efficient way of oil production. Second oil price shock occurred in 1979; as a result of the Iranian revolution. Iraq invaded Iran to begin a start of new war between two oil giants. As a result, the oil production of both countries was significantly dented.

The oil price remained high for another thirteen years until 1983, when OPEC cartel was broken due to the non-compliance from Saudi Arabia. As they wanted to take the majority of the oil market share, as a result, there was oversupply of oil in the market then the actual demand of oil. One more reason to the negative shock was the economies of the Western Europe, U.S. and Japan had slowed

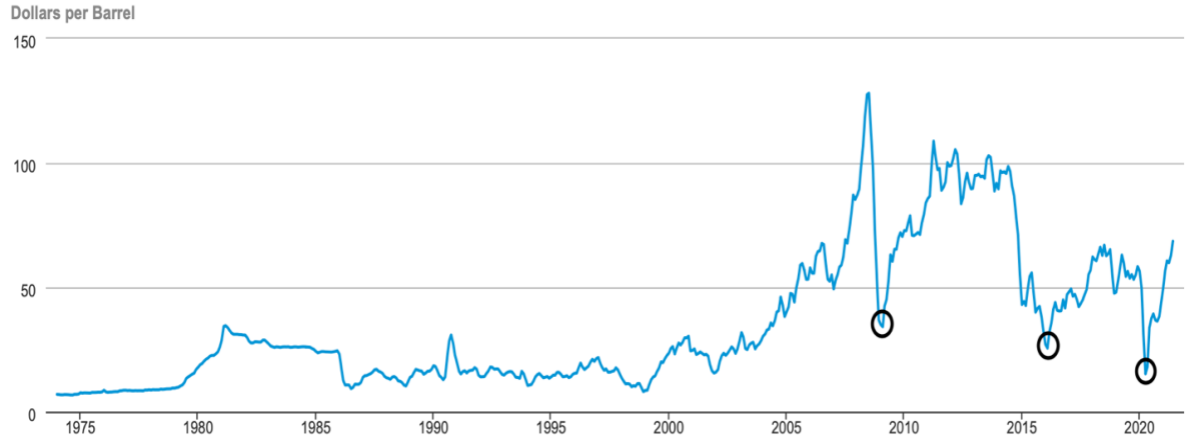
down during the 1970s crisis. As a result, the oil demand was not growing at the pace as it was previously anticipated. The revenues of OPEC members had drastically been reduced during 1983-85. All oil producers suffered from price drop with the exception of Saudi Arabia, as the declined oil prices was offset by their increased market share [Gately et al., 1986]. The oil prices peaked historically in 1980 at $37.42/bbl and shattered to just $10.34/bbl in 1986. The price was back to where they belong before 1973 crisis. But it rose again in span of months from $15.1/bbl in June, 1990 to $36.02/bbl in Oct 1990 but declined again, where then it oscillated between $18/bbl to $23/bbl until 1998 [Brent price data, 2021].

The oil exporters again brought themselves upon a new price slump with the expansion of their oil market share. Brent price fells in first four months of 1998 that caused tensions for the government and companies regarding the falling revenues. In Dec 1998, Brent oil price fell to $9.82/bbl, the lowest since the early 1970s. The revenue losses ranged from 40-54 % for exporters like Saudi Arabia and Mexico [Mabro, 1998]. This damage was an outcome of an excess productive capacity available for Saudi Arabia, Kuwait and U.A.E, as these countries were restricting the production to the given quota until 1997. The dropped price between Dec 1997 and April 1998 was a last warning for the oil producers. So, any incompliance within the group to capture more share and revenue will only be short-lived. While, the consequences will be paid by heavy penalty in shape of falling oil price and revenues. That would affect the producers, regardless of the size producer and the market share it controls.

Afterwards, oil saw a continues surge in 2003-08, in this period the price gradually increased from under $25/bbl to a new record for the commodity, about $147.3/bbl on July, 2008 as shown in figure 1. The period driven by the unprecedented demand shocks from the emerging economies for the booming economic growth of newly industrialized countries [Stevenson, Emma, 2018]. The global surge in the economic growth offsets the oil price. The main source of the oil demand was the growth driven economy of China. The world was becoming more globalized and trade was increasing substantially as well as there was new demand from the free business and new consumers from the emerging markets. The birth of the new businesses, increased in buying power and sells of vehicles drove new markets for oil exporters, which made new customers for the hunger in global oil demand. It was clear that there was not enough supply present to meet the required demand. Hence, the oil price continued to increase and went all time high. One more factor played a key role in price hikes was the strengthening of Euro exchange rate against the USD, which is the currency in which oil trade takes place. As the Euro got stronger against USD, the price of commodity went up. One other reason for the shock for exporters was the excellent coordination and policy shifts between the OPEC group led by Saudi Arabia and non-OPEC led by Russia. Before that, the countries used to drive the price down intentionally to capture market share. Countries that were most affected by the price hike

were China and U.S. Since, they are still the two biggest oil importers along with the size of their economies and the industrial growth relied heavily on fuels. Both countries have fair domestic oil production, but depend more on the foreign imported oil than the domestic supply. U.S urged the OPEC group to drive down the oil prices by increasing the oil production to the level of demand. These price hike shocks negatively impact the emerging economic and their long-term sustainable growth as the commodity price rises. In Contrast, OPEC decided to cut production instead in 2007. This fueled the oil prices sky rocket and the oil prices keep making new records that drives a massive imbalance between supply and demand. As there was demand present to keep up with the growth in emerging markets from India and China.

Oil price increased by $97/bbl during the span of five years in 2003-08, of which 51 % increase in oil price was due to the weakening of USD as found by one of the authors [Hanke, 2008]. Taking the devaluation into account, the weakening of USD impacted the revenue of oil exporters. To compensate this, the producers keep cutting oil supplies to make more cash per barrel from crude oil sales to the market. The slump shock in oil price had negative response for oil exporters, the world recession of 2008-09 period caused the demand for energy to shrink. Consequently, the Brent price crashed from $132.72/bbl to $39.95/bbl in that period as shown in Fig.1 (WTI price dropped from $147.3/bbl on July 2008 to $32/bbl on Dec 2008). In a span of just six months, the WTI crude price lost 80 % of its value. OPEC cut the production by 16 % in eight months to bring some stability to the international crude price [Hamilton, 2009]. This decision brought fast recovery in oil price, which later on stayed above $70/bbl and peaked $100/bbl until 2014.



Source: US energy information administration data, 2021

Figure 1 – Brent crude oil price history, 1975-2021

The Brent price again reached its second peak to $111.8/bbl in June, 2014. Then, another plunge takes place during 2014-16 period when oil price again lost 70 % of its value. This time the role of bringing the price down was played by the U.S, for their investment in the new technologies for unconventional resources and energy sector that shaped a new shale-oil boom. Some geopolitical situation of the Middle-east, weaker growth in the emerging markets, OPEC reactions and the U.S

becoming self-sufficient for its domestic oil demand played this rule to shatter oil brent price once again from its peak $102.96/bbl in Aug, 2013 to just $25.52/bbl in Feb, 2016. An all-time low by adjusting inflation of the currency as shown in figure 1 [Oil market report, 2016].

Since 2016, the oil price grew smoothly due to policy shifts and new agreements but as a result of the COVID-19 pandemic, the price fell to a level that was unthinkable in 2020, that affected the major oil producing economics for that period by the aftershocks were faced by all world economies. The outcome after that caused dramatic changes to crude oil trades. Demand for oil fell by 29 million barrel/day (about 30 %) compared to a year ago, the lowest demand since 1995 [Oil market report, 2020]. And for the first time in history, on 20th April 2020, WTI crude oil price plunged to negative -$37/bbl as a result of the weakening demand. That too was coupled by excessive production output that exceeded the storage spare capacity of crude for many countries. While, when the lowest crude price crashed happened on April 2020, brent price hit as low as to just $15.2/bbl as shown in figure 1.

Since many economies are getting back to normal and the demand of oil has raised to the level of pre-pandemic. Many analysts predict the upcoming years are expected to show a boom in oil prices, when the emerging markets will start to recover to show sign of growth. OPEC and its partner formed new OPEC+ that made a deal to cut the supply to level with the demands to further stabilize the price. Until Sept 2021, brent oil price stand at $75/bbl and it continue to rise. After a new regional development of Russian invasion of Ukraine, the prices are stable up to $120/bbl in June 2022 and are expected to rise after the sanction on Russian Oil imports. It is hard to forecast the oil price with unexpected shocks and regional conflicts makes new bubble in price with no long-term stability. The current of oil will allow for the discovery of new reserves. Also making the unconventional reserves shale oil, oil sand and deep-water oil to become economically viable. The price below a certain marker is no longer break-even for oil producers. In order to achieve the next objective of this paper, a model is needed to determine the impact of shocks on major oil producers worldwide. That would help in better understanding of the macro economic problems the exporting countries face during the price slump and its aftershocks.

CHAPTER 3. METHODOLOGY AND DATA COLLECTION

In this chapter, the methodologies used by previous authors are examined. The countries on which the authors worked on, the method used and their relevant findings is also mentioned. Then, the macroeconomic indicators are decided after that a relevant model is built. Following this the data is collected from the reliable sources for the major oil-exporting countries. The countries are then classified into variety of groups, and large groups are broken into small sub-groups regionally for the better analysis within and among the sub-groups.

3.1. Model building

In this section, the effect of crude oil price shocks for some fundamental macroeconomic indications are determined. In order to do that the most relevant indicators are needed to be selected for building the model. Firstly, the revenue for the countries comes in shape of exports, thus the data of merchandise exports is collected for selected countries. Then, the next indicator that is of significant importance is the foreign reserves that export of the commodity brings. Since, oil is only traded internationally in USD, so the central bank data will indicate the inflow and outflow of the foreign currency and can be a good indicator to show the financial health of the economy. Afterwards, the natural currency fluctuation is measured by its nominal exchange rate and is a proven indicator to show the stability of the country. Stable currencies in long-tern are proven to be strong and reveals the economic strength of one's economy. Now comes the one of the aims of this paper, that has to do with the governments of the oil exporting states. The revenue collection and expenditure are important indicators to tell the health of economy. Too much deficit suggests the government is missing the revenue targets or either the government is over-spending. Thus, fiscal balance as a macroeconomic indicator is chosen as a percentage of the GDP, positive fiscal balance would indicate the government further spend its revenue on its people. Lastly, the GDP growth is one of the profound macroeconomic indicator that can shows the annual growth in the economy while also suggesting the long-term policies of the country.

Hence after going through the required macroeconomic indicators for the model and its analysis, there is a total five domestic macroeconomic indicators i.e., merchandise exports, foreign exchange reserves, nominal effective exchange rate, fiscal balance, and GDP growth that is used in this model building.

The selections of methodology come after reviewing all the relevant research papers that dealt with oil price volatility and its impact on various economies. A little collection of it is mentioned in Table 1 that shows some of the important findings by the authors, the countries in which they investigated their research on and the method used for the work. Although there are several models that tried to achieve the same goal of finding the most precise methodology for oil price impacts on the economies. Several studies have done research on the macroeconomic impacts of oil prices using

a VAR approach pioneered by Hamilton [Hamilton, 1983]. Recent papers have used this approach in order to investigate the determinants of real-world oil prices [Kilian, 2009]. VAR model is proven to be appropriate and superior to vector error correction (VEC) model in terms of short-run forecast variance [Chen et al., 2016]. According to some research oil prices are determined in the global market and considered as exogenous variable [Li et al., 2016]. Few papers have used modified version of SVAR method for the macroeconomic changes in the economies that was developed by Kilan, 2009. The modified version of SVAR takes into account the trade, GDP per capita and the exchange rates [Mukhtarov et al., 2021].

Table 1 – Similar research findings and the methodology

Author(s)	Countries	Method	Findings
Berument et al. (2010)	MENA countries	VAR, OLS	oil price change has an effect on the oil-exporting countries' outputs.
Alao, Payaslioglu (2021)	Brazil, Mexico and 35 OECD countries	GARCH models	recommends new oil exporters should diversify their economies and invest into non-oil exports for alternate revenues.
Delpachitra et al. (2020)	Canada	new open economy macroeconomics (NOEM) model	domestic monetary policy is a key channel that has greater response than foreign monetary policy that propagate price shock through the international channel
Yildirim, Arifli (2021)	Azerbaijan	VAR	negative oil price shock deteriorates trade balance, decreases the real effective exchange rate and cause a recession and high inflation.
Burakov (2017)	Russia	VECM	oil price has a long-run relationship with economic growth and it has direct effect on economic growth in the short-run.
Musa (2017)	Saudi Arabia	ARDL	oil shock has a considerably high positive effect on the GDP growth rates.
Mensah et al. (2017)	Five oil-exporting countries	VAR	oil price in the long run has an equilibrium relationship with exchange rate, especially for national currencies of oil-rich countries.
Chen et al. (2016)	16 OECD countries	VAR	nonlinear relations between oil prices and exchange rates

End of Table 1

Author(s)	Countries	Method	Findings
Alekhina, Yoshino (2018)	non-OPEC oil exporter	VAR	an increase in oil prices may continuously and positively affect the real GDP growth, decrease CPI inflation and interest rate, and lead to domestic exchange rate appreciation.
Vohra (2017)	GCC countries	CAD Model (current account defict)	falling and volatile oil prices and economic growth as driving force behind growing budget deficits and dwindling current accounts in GCC nations.
Gupta (2008)	26 net oil-importing countries	OVI (Oil vulnerability index) using PCA	there are considerable differences in the values of individual indicators of oil vulnerability and overall oil vulnerability index among the countries
Raouf (2021)	Oil importers and oil exporters	VAR	oil price shocks affect government current expenditure positively. While it affects government capital expenditure positively in oil-exporting and negatively in oil-importing countries.
Mukhtarov (2021)	Azerbaijan	SVAR	positive shock in oil price increases trade turnover, GDP per capita and appreciate local currency.
Kilian (2008)	U.S	VAR	oil prices are driven by structural demand and supply shocks which may have direct effects on the U.S. economy and an indirect effect on operating through the price of oil.

Source: Compiled by author from the similar research topics

Thus, after going through the findings the relevance of the paper, it was decided that to build the model on the foundation of SVAR method as developed by Kilan and investigate the macroeconomic changes of oil exporters to oil price shocks. Structural vector autoregressive (SVAR) models have an advantage over traditional large-scale macro-econometric models, as it is used in academic and policymaking, used for policy analysis, business cycle fluctuations, and forecasting purposes [Kilan, 2009]. The results are not complicated and large structure, but easily interpreted, available and understood by the reader. Hence the simplicity and accuracy of SVAR model, helps the

analysis to estimate the output gap because they combine together to form a rich statistical framework with the ability to integrate alternative economic constraints. Few studies that have estimated the relationship between an oil price change and the macroeconomic of oil-exporting countries that takes into account variety of economies in the research. Additionally, the COVID-19 pandemic that slowed down the major world economies, and its impact on the developing and emerging economies is yet to be reviewed.

In this structural VAR model, the fundamental macroeconomic indicators are considered, oil price is an exogenous variable that affect a countries' fundamental economic performance variables: exports, reserves, exchange rate, fiscal balance, and GDP growth. oil shocks are assumed to exogenous to exchange rates in the short-term. It is impossible that a small open economy can affect oil supply, demand or price in the short-term [Chen et al., 2016]. The main macroeconomic indicator that is the most relevant for out topic is the fiscal balance of government. It is worth noting that the fiscal balance and foreign exchange reserves are new macroeconomic indicators used in this relevancy of such topic and not included by authors in previous literatures. However, some attempts had been made in form of revenue collection by government from its oil exports. The foreign reserves indicate the inflow of USD in the central banks. Surplus in fiscal balance would indicate in oil price hikes for oil dependent economies and deficit in fiscal balance after price slumps would mean large dependency on oil revenues. The model also includes the exchange rate in order to capture the indirect effect of oil price volatility on the main macroeconomic indicator through the trade channel respectively. However, it is assumed that these five variables of a domestic economic cannot affect the world oil price. The economic variables of the countries are affected by the present zero and later lag values (up to 2 lag) to oil price fluctuations.

For the empirical part, a unit root test is performed to analyze whether the time series variables are non-stationary and possesses a unit root. The null hypothesis rejection at 1%, 5% and 10% are tested, if significant it implies that the data series is not stationary. The ADF unit root test, DF–GLS unit root test, and PP unit root test are performed to check the non-stationarity properties of variables. Secondly, the lag criteria test is performed to determine the lag period of variables. Then, an impulse-response (IRF) and variance decomposition (VD) together with the SVAR method are used to examine period of recovery for the impact of oil price on exports, reserves, exchange rate, fiscal balance, and GDP growth. Impulse response function is used to check results from our SVAR system for an impulse input. Variance decomposition is used to examine the variance of macroeconomic indicators by oil price. In order to assess the interrelationship between the oil price volatility and the macroeconomic performance of an economy, we consider the structural VAR model as shown in equation (3.1), (3.2) as following:

$$Ax_t = a_0 + \sum_{n=1}^{k}(A_i x_{i-1} + \varepsilon_t) \qquad (3.1)$$

$$e = A^{-1}\,\mathcal{E}_t \tag{3.2}$$

where

A – 6 × 6 contemporaneous matrices,

x_t – (*OP, EXP, RES & EXC, FisBal, GDPg*),

a_0 – the vector of constant terms,

k – the optimal lag,

A_i – the autoregressive coefficient matrices,

ε_t – a vector of mutually and structural innovation.

When A^{-1} is evaluated, the evaluated vector of structural shocks, ε_t is found. The responses of x_t to each structural shock can be determined since x_t consists of 6 variables. Thus, e_t as shown in equation (3.3), indicates the reduced form of VAR innovations.

$$e_t = {e_t}^{OP} \tag{3.3}$$

$$e_t = \begin{Bmatrix} {e_t}^{OP} \\ {e_t}^{exp} \\ {e_t}^{res} \\ {e_t}^{exc} \\ {e_t}^{fis} \\ {e_t}^{gdp} \end{Bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{Bmatrix} {\varepsilon_t}^{OP} \\ {\varepsilon_t}^{exp} \\ {\varepsilon_t}^{res} \\ {\varepsilon_t}^{exc} \\ {\varepsilon_t}^{fis} \\ {\varepsilon_t}^{gdp} \end{Bmatrix}$$

where

0 – denotes no expected contemporaneous responses to particular shocks are expected.

The non-zero elements a_{ij} (i = 1, 2, 3, 4, 5, 6; j = 1, 2, 3, 4, 5, 6) are the coefficients that indicate the responses of i to the shocks in j.

SVAR matrix system follows a sequence in which it follows from exogenous to endogenous variables. It is consistent with the individual variable's responses to the shock's outcome. The restrictions deployed in the matrix system in the SVAR method are based on the economic theories.

The oil price is the first variable in the SVAR matrix, it affects all following variables below in the matrix but it is not affected by other variables in the period *t*. As many big oil exporters are part of global oil market of which only few countries have the power to affect oil prices by changing their production level according to supply and demand while the majority of oil exporters do not affect the international price of crude. Thus, like other literatures oil prices are considered external in this study that cannot be alter by a change of one macroeconomic indicator of any country. Exports are in the second row of the matrix and it receive the shock response from only the oil price shocks not from the indicators below it in the matrix. The third row of the matrix includes foreign reserves, it affects all the variables below it but it has no effected on the exports and oil price. The fourth row of the matrix includes nominal effective exchange rate, it affects all the variables in row 5-6 but it has no effect on the reserves, exports and oil price. It is assumed not to respond to changes in internal

variables simultaneously. The fiscal balance is the fifth variable in the SVAR matrix. It is presumed that except for *GDP* growth, the fiscal balance is influenced by all factors above in the matrix from row 1 –4 and also not respond to the internal variables. The final row includes GDP growth is not subject to any restrictions, thus the GDP growth responds to changes in all variables above in the matrix. In conclusion, the oil price is the first variable, followed by exports, reserves, exchange rate, fiscal balance, and GDP growth in this SVAR model matrix.

3.2. Source of data

For the empirical analysis, annual data ranging from 1991 to 2020 for the brent crude oil price (*OP*), merchandise exports (*EXP*), foreign reserves (*RES*), nominal effective exchange rate (*EXC*), fiscal balance (*FisBal*) and GDP growth (*GDPg*) are collected for the major oil exporting countries. Countries that have an annual crude oil exports of minimum $2 Billion in year 2019.

The data for Brent crude oil price is from EIA annual data for average Brent oil price.

Annual merchandise exports data from WTO.

Annual average nominal effective exchange rate in local current to U.S.D collected from IMF.

Central Bank foreign exchange reserves is U.S.D minus the gold is from IMF data.

Annual fiscal balance as a percentage of *GDP* that is the govt. expenditures minus govt. revenues is collected from IMF data

Annual GDP growth is taken from World Bank and OECD Data.

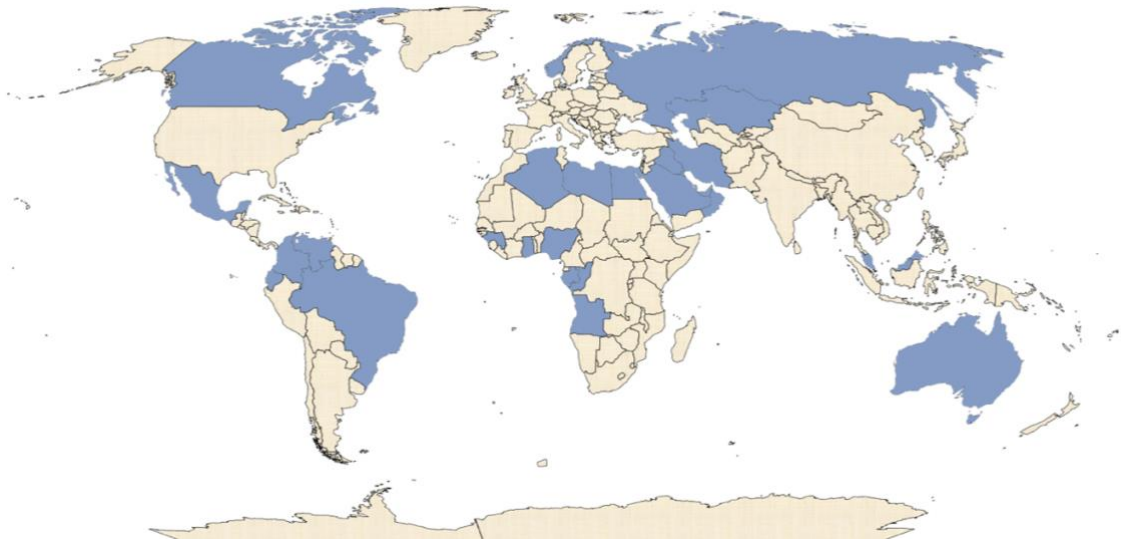
Oil price is in USD per barrel from EIA data, while the exchange rate is proxied with national currency per USD. All other variables i.e., exports, reserves are in USD. The fiscal balance and GDP growth are used as a percentage of the *GDP*. All variables are in logarithmic form. The data is collected and worked on Microsoft Excel, then processed on EViews software for the empirical analysis.

3.3. Classifying the major oil exporters

The most impactful factor that plays a key role in the oil sales profit is the marginal cost of crude oil production against the benchmark selling price of crude. Every country makes different profit depending upon the region from where the oil is being produced. It is a general fact that the conventional oil is way cheaper to produce in dollars per barrel $/bbl than unconventional oil reserves with higher average production rate. Hence, the countries that has naturally conventional reserves i.e., Middle Eastern region, make more revenue and profit from crude exports and by-products than the rest of the world. While the producers in other regions i.e., North American, South American etc. where the companies have higher break-even margins to extract crude oil do not make the similar profits. In those regions the crude oil is produced mostly from unconventional methods and resources. Thus, a marginal production cost is way higher and consequently the revenues are way lower than the conventional reserves' country. These countries do not make break-even profit from the crude oil

sales when international price falls below a certain point. So, the country would rather not produce and export their oil at such price point.

The paper classifies the oil exporting countries into three separate groups as classified by the UN world economic situation prospects into developed economies, transitional economies and developing economies status [UN world economic situation prospects, 2019]. The developing economies are further classified regionally. Furthermore, the countries with minimum two billion U.S.D exports annually are chosen to investigate the reaction of major oil-exporters to crude oil shocks, the selected countries are shown in figure 2.



Source: Compiled by the author for selected major oil exporting countries counties

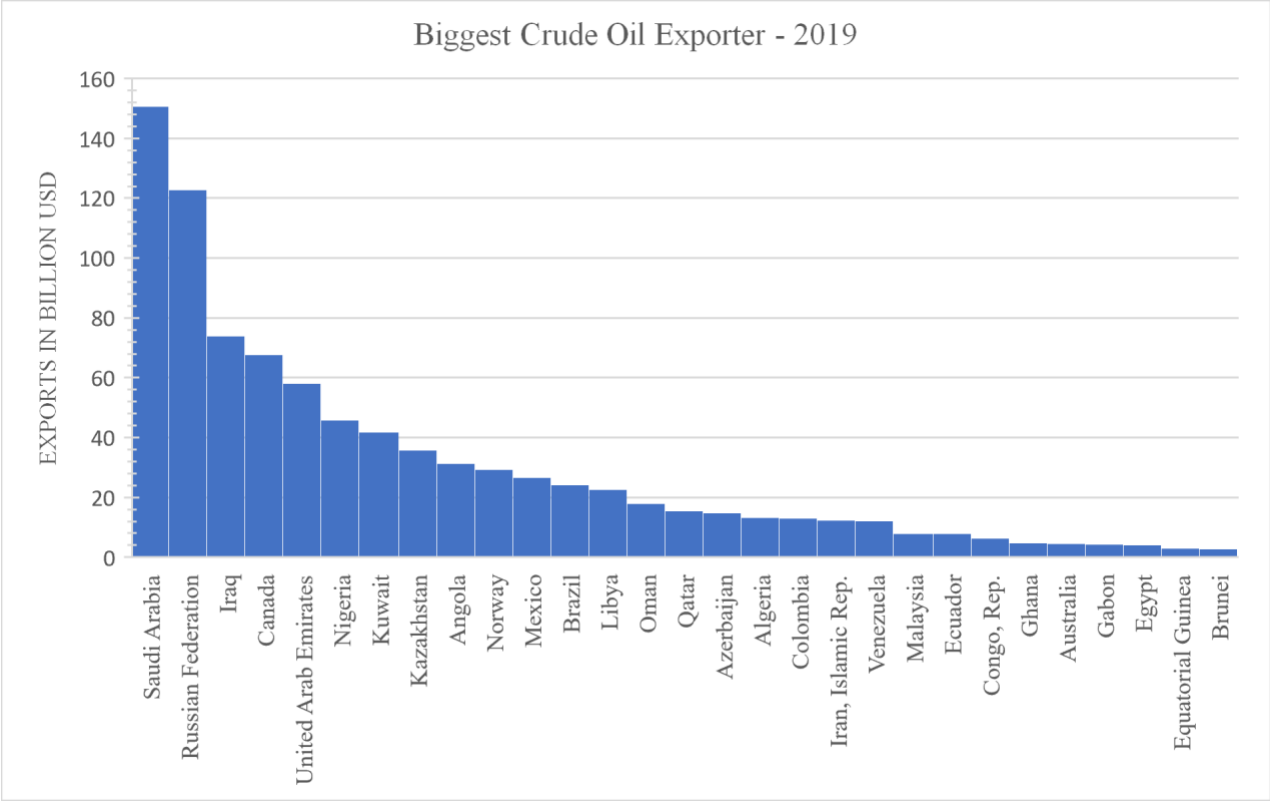
Figure 2 – Major net oil exporting countries globally (Represented in Blue)

Table 2 – Biggest crude oil exporting country in billion USD exports, 2019

Country	Exports (in Billion USD)	Share	Country	Exports (in Billion USD)	Share
Saudi Arabia	150.6	15.2%	Azerbaijan	14.9	1.50%
Russian	122.9	12.40%	Algeria	13.2	1.33%
Iraq	74.0	7.47%	Colombia	13.1	1.32%
Canada	67.7	6.83%	Iran	12.4	1.25%
U.A.E	58.1	5.86%	Venezuela	12.1	1.22%
Nigeria	45.9	4.63%	Malaysia	7.9	0.80%
Kuwait	41.7	4.21%	Ecuador	7.8	0.79%
Kazakhstan	35.9	3.62%	Congo, Rep.	6.2	0.63%
Angola	31.2	3.14%	Ghana	4.7	0.47%
Norway	29.2	2.95%	Australia	4.4	0.45%
Mexico	26.6	2.68%	Gabon	4.3	0.43%
Brazil	24.3	2.45%	Egypt	4.2	0.42%
Libya	22.6	2.28%	Equ. Guinea	3.1	0.31%
Oman	18.0	1.81%	Brunei	2.7	0.27%
Qatar	15.4	1.55%			

Source: OEC crude oil export data – 2019

The countries that are net-exporter of crude oil are chosen. Some developed economies have large crude oil productions i.e., Netherlands, U.K, U.S etc. but they are dropped from the analysis as they import more oil than they export. WTO data is used to find the major oil exporter globally. For reference, the exports in USD and the share of exports globally of each country are given and represented in table 2 and illustrated visually in figure 3. The table reveals a huge dominance of few players that hold the majority of crude oil exports, supply and the demand of this commodity. Then, the macroeconomic indicators are assessed in the classified categories as developed, transition and developing economies as follow.



Source: OEC crude oil export data – 2019

Figure 3 – Top twenty-nine crude oil exporting economies (net exports) – from OEC data 2019

Developed economies

The following group consist of countries that are highly advanced, developed and their economy is matured enough. These countries generally have high GDP per capita and the economies of these countries are generally very diversified (with some exception). These countries have stable exchange rate as their local currency are stable against the USD and they have economies that follows growth-oriented policies. Although many developed countries might not have the largest reserves of hydrocarbon as compared to to the rest of the world. But they have high level of expertise and advanced technologies to extract oil unconventionally as well. The developed countries use modern unconventional technologies to extract crude oil. For example, oil sand, shale oil, horizontal well drilling and fracturing reduces the profitability from crude oil. While, oil still makes a major source

of revenue, taxes or royalties for these government but the economies are wide enough to survive oil price shocks. The countries selected for the analysis include Australia, Canada and Norway. Some countries i.e., U.S, U.K, Netherlands were either major oil exporters in past or still export a lot of oil but the they are actually total net-importer of crude oil.

Transitional economies

Economies in transitions consists of countries that are making some radical macroeconomic transformation in order to change the way in which their economies are operated. Traditionally such countries are making a structural alteration from a state-run economy towards more market-led economic system. This includes economic liberalization, trade barrier removal and privatization of state-owned enterprises. The countries selected for the analysis include Azerbaijan, Kazakhstan and Russian Federation.

Developing economies

There are about 23 countries in this category, so they are further divided into sub-groups regionally. Some of these economies are classified as oil-rich countries developing countries. Many developing economies heavily relies on the petroleum products for their energy demand and transportation sector and some of developing countries are lucky enough to be an exporter of crude oil. Many governments of the developing economies solely depend on the oil export revenues to operate the state affairs. Some of which suffer from resource curse, despite having the crude resource they are unable to develop their economies and spend on their economic growth. Some developing countries has large share of oil that contribute to their GDP.

The countries are further divided into sub-groups regionally for the easier understanding and analysis. Developing economies generally do not have stable exchange, so oil price slumps suffer their revenue collection and later have balance of payment issues. The governments are relying on the foreign reserves and oil export revenues to keep their balance of payments stable and finance their budget. During oil crisis and aftershocks causes debt issues to as the governments borrow excess money to finance their expenditures.

The Middle East sub-group are separated from the rest of Asian region. As they have large oil resources, oil has the largest contribution to their GDP and the largest pie of government's revenue. The countries are known to be oil-rich, their currencies pegged to the USD (except Kuwaiti dinar which is pegged with group of strong currencies), so the financial crisis do not affect their export revenue in USD, since all the oil is traded in USD. North African region is separated from main African region. Some countries from Africa, North America and Asia have low volume of crude exports compared to other oil giants. But the overall economic size of these countries is much smaller, thus they could be the most severely affected countries due to oil price shocks. Developing economies are divided into the following sub-groups of for the analysis.

(i) **Africa:** Angola, Congo Rep., Equatorial Guinea, Gabon, Ghana, Nigeria.

(ii) **Asia:** Brunei, Iran, Malaysia.

(iii) **North Africa:** Algeria, Egypt, Libya.

(iv) **Middle East:** Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates.

(v) **South America:** Brazil, Colombia, Ecuador, Latin, Venezuela.

In conclusion, couple of the objective of the paper were accomplished in this chapter. That includes the model building, finding the best methodology from the literature reviews of previous authors on relevant topics, macroeconomic variable selections, the data collection from the open sources like IMF, WB, WTO, EIA etc. and lastly the classification of countries by their economic status in the UN report 2019. After the classification, next objective is to analyze the data in our model through the use of EViews software and compare the trends of each individual country within the group as well as the groups among themselves. So, the next chapter will perform the empirical analysis from the data collection for the past three decade for major crude oil exporting countries.

CHAPTER 4. EMPIRICAL ANALYSIS OF THE MACROECONOMIC VARIABLE

The fourth chapter includes the main empirical evidence on the macroeconomic indicators of oil exporting economies, by measuring the relative impact of external oil price impulse on an individual economy. The chapter will be sub-divided in four parts, as unit root test for checking the presence of non-stationary variables and seasonality, lag criteria test to find the optimal lag, impulse response function and the variance decomposition. Summary and some recommendations are mention in at the end of the chapter.

4.1. Unit root test

The first step is the stationarity features testing of the macroeconomic variables of the SVAR model. To ensure the stationary properties for the analysis, unit root tests are conducted and checked with the ADF, DF–GLS, and PP unit root tests, and the results are shown in the tables for individual countries in the appendix. Unit root tests confirm that the variables have a unit root in level and null hypothesis rejection at 1 %, 5 % and 10 % are tested. Significant variation implies that the data series is not stationary in our data. In that case, seasonality of the data is refined to get the stationary data of every variable for all the countries. The summary of all stationary of data is represented below in table 3.

The results of unit root tests for the time series and the series after taking the first difference, respectively. It can be seen that most of the time series of our selected variables of contain the unit roots. The unit roots are performed on level order and first order difference, the lag period is mentioned next to it. The null hypothesis rejection is tested and the outcomes are used by the majority of these three tests. The first order difference series show the stationary properties of the data. Therefore, we can conclude that oil price, exports, foreign reserves, nominal exchange rate, fiscal balance and *GDP* growth time series have unit roots and their first order differences are stationary.

Table 3 – Unit root test of all macroeconomic variables for all countries.

Developed	***Exports***	***Reserves***	***NEER***	***Fis-Bal***	***GDPg***
Australia	*1%*	*1%*	*5%*	***>10%***	*1%*
Canada	*1%*	*1%*	***>10%***	***>10%***	*1%*
Norway	*1%*	*1%*	*1%*	*1%*	*1%*
Transitional					
Azerbaijan	*10%*	*1%*	*5%*	*1%*	*1%*
Kazakhstan	*1%*	*1%*	*1%*	*5%*	*1%*
Russian	*1%*	*1%*	***>10%***	*1%*	*1%*
Asia					
Brunei	*1%*	***>10%***	*10%*	*1%*	*1%*
Iran	*1%*	*No Data*	*1%*	*1%*	*1%*
Malaysia	*1%*	*1%*	*1%*	*1%*	*1%*

End of table 3

African					
Angola	*5%*	*1%*	***>10%***	*1%*	*1%*
Congo, Rep.	*1%*	*1%*	*1%*	*1%*	*1%*
Guinea	*1%*	*1%*	*1%*	*1%*	*1%*
Gabon	*1%*	*1%*	*1%*	*1%*	*1%*
Ghana	*1%*	*1%*	*5%*	*1%*	*1%*
Nigeria	*1%*	*1%*	*1%*	*1%*	*1%*
Middle East					
Iraq	*1%*	***>10%***	*No Data*	*5%*	*1%*
Kuwait	*1%*	*1%*	*No Data*	*1%*	*1%*
Oman	*1%*	*1%*	*No Data*	*1%*	*1%*
Qatar	*5%*	*1%*	*No Data*	*1%*	*1%*
Saudi Arabia	*1%*	*1%*	*No Data*	*1%*	*1%*
U.A.E	*1%*	*1%*	*No Data*	*1%*	*1%*
North Africa					
Algeria	*1%*	*1%*	*10%*	*1%*	*1%*
Egypt	*1%*	*5%*	*10%*	*1%*	*1%*
Libya	*1%*	*10%*	*1%*	*1%*	*1%*
Latin America					
Brazil	*1%*	*5%*	***>10%***	*1%*	*1%*
Colombia	*10%*	*5%*	*10%*	*1%*	*1%*
Ecuador	*1%*	*1%*	*No Data*	*5%*	*1%*
Mexico	*1%*	*1%*	*1%*	*1%*	*1%*
Venezuela	*10%*	*1%*	*1%*	*1%*	*1%*

Source: Compiled by the author from the preliminary analysis (details in appendix)

4.2. Optimal lag criteria test

This section performs the optimal lag period for each country. A Structural VAR model was initially specified including the endogenous variables of crude oil price, exports, foreign exchange reserves, nominal effective exchange rate, fiscal balance, and *GDP* growth with a randomly selected lag interval and determination test was applied to the residuals. The optimal lag length is selected from the majority selection of these five criteria. Sequential modified LR test statistic (each test at 5% level), final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). The optimal lag chosen is given on the table 4 for all countries and the details are summarized in appendix for each individual country.

Table 4 – Optimal lag selection of all macroeconomic variables for all countries

			Developed		***Transitional***	
Country	*Australia*	*Canada*	*Norway*	*Azerbaijan*	*Kazakhstan*	*Russian*
Lag	*2*	*2*	*2*	*2*	*1*	*2*
			Asia		***North Africa***	
Country	*Brunei*	*Iran*	*Malaysia*	*Algeria*	*Egypt*	*Libya*
Lag	*2*	*1*	*2*	*1*	*2*	*1*
			African			
Country	*Angola*	*Congo, Rep.*	*Guinea*	*Gabon*	*Ghana*	*Nigeria*
Lag	*2*	*1*	*2*	*2*	*1*	*1*
			Middle East			
Country	*Iraq*	*Kuwait*	*Oman*	*Qatar*	*Saudi Arabia*	*U.A.E*
Lag	*1*	*1*	*2*	*2*	*1*	*1*
			Latin America			
Country	*Brazil*	*Colombia*	*Ecuador*	*Mexico*	*Venezuela*	
Lag	*1*	*2*	*1*	*2*	*2*	

Source: Compiled by the author from the preliminary analysis (details in appendix)

4.3. Impulse response function (IRF)

For the third step, impulse response analysis is performed to understand the effects of the shocks on the variables. The estimated impulse response function was employed to see the dynamic responses of crude oil price, exports, foreign exchange reserves, nominal effective exchange rate, fiscal balance, and *GDP* growth to oil price shocks in the SVAR system. The basic aim is to identify the responses of the variables against any future shock in oil price. IRF test shows which variable are most affected by the impulse oil shock and the reactions given by these variables for 10 forecast horizons for each countries. Some similarities are found within the classified groups.

Developed economies

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 5.1, 5.2 and 5.3 for Australia, Canada and Norway respectively (in Appendix A). The results show that the response of exports to oil price is positive in first period and start to decline while Norway show a steady decline until 10th period. Although for reserves, the effect is positive for first period in Australia and Norway while it reveals negative effect on Canada's reserve, which later stabilizes until the 4th period. The oil price shock causes rise in oil revenue and in the foreign currency flow and hence the increase foreign reserves. The exchange rate response to S.D. oil shock is negative during initial 2 –3 periods. It suggests that during high oil price, the exchange rate declines. In other words, the currency appreciates for initial 2 –3 periods then stabilize. The response of fiscal balance to oil price shock is only significant for first three periods, as its positive for that period. Lastly, the IRF of GDP growth is positive during the first period only, which means an OP rise results in an increase in GDP growth for only its next period.

Transitional economies

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 6.1, 6.2 and 6.3 for Azerbaijan, Kazakhstan and Russian Federation respectively (in Appendix B). The outcomes indicate that the response of exports to oil price is positive until 2nd period and start to decline for Azerbaijan and Russia while Kazakhstan show steady decline until 5th period. The effects are positive for reserves for two period for all countries, while it shows negative effect on Russian reserves after 2nd period until the 5th period. The exchange rate reaction to oil impulse is negative for Russia after 2nd period while it is positive for Azerbaijan until 2nd period and declines after that. It suggests that high oil prices actually the depreciates Azerbaijan economy until 2nd period after which it starts appreciate. The IRF of fiscal balance to oil impulse is positive one period after the shock, then it starts to decline until the 4th period. The response of *GDP* growth to oil price shock peaks until the 2nd period, which means an OP hike has its positive impact on the *GDP* growth for couple of periods.

Developing economies

Asia – **(**Brunei, Iran, Malaysia)

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 7.1, 7.2 and 7.3 for Brunei, Malaysia and Iran respectively (in Appendix C). The outcomes indicate the response of exports to oil price is positive for all countries until 3rd period for Brunei and Malaysia, while Iran shows long-term stability that indicates positive exports revenue boom from price hikes. The impact on reserves shows positive increase until 4th period. The IRF of exchange rate to oil price induction is negative for Iran and Malaysia for only 2nd periods, which shows the currency starts to appreciate against USD initially. The response of fiscal balance to *OP* impulse is positive for only one period after the impulse, then it starts to decline after the 3rd. Malaysia fiscal response is negative, implying its less reliance on oil for the fiscal structure of government revenue collection. The response of GDP growth to OP impulse peaks in 1st period, implying positive shock have its favorable impact on the GDP growth until the next financial year.

Africa – **(**Angola, Congo Rep., Equatorial Guinea, Gabon, Ghana, Nigeria)

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 8.1, 8.2, 8.3, 8.4, 8.5 and 8.6 for Angola, Congo Rep., Equatorial Guinea, Gabon, Ghana, Nigeria respectively (in Appendix D). The outcomes indicate the response of exports to oil price is positive for all countries and the it peaks in the 1st period for all countries, except Ghana. Afterwards countries show slow steady decline and stabilized for long period that indicates favorable exports revenue boom from oil price hike for upcoming periods. The reserves have also positive impact on all countries except

Ghana, that indicates this country does not rely on foreign currency inflow from oil exports. Gabon and Congo Rep. shows positive and steady reserves for all 10 periods, while it declines for Nigeria after 4th period. The response of *NEER* to *OP* impulse is negative for all countries except Ghana, that reveals devaluation of Ghana's currency. For Nigeria it suggests the local currency appreciate after 2nd period and the currency appreciation is for long period for Nigeria, Angola, Congo Rep. and Gabon. The response of fiscal balance to *OP* impulse is positive for the beginning 2 –3 periods for all countries after the impulse. Congo Rep. show positive fiscal balance response until 6th period. That illustrate high reliance on oil for the government's revenue collection. The response of *GDP* growth to *OP* impulse is positive for all countries in 1st period for all African countries except Gabon, which means an oil price rise have its favorable impact on the *GDP* growth for African countries in first financial period that helps them to stimulate the economic growth, while a decline indicates the growth suffers to *OP* impulse.

Middle East – **(**Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates)

The IRF of exchange rate for this group is not performed because the national currencies are pegged to USD. The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 9.1, 9.2, 9.3, 9.4, 9.5 and 9.6 for Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates respectively (in Appendix E). The outcomes reveal that the response of exports to *OP* is massively positive for all countries and steady until the end of 10th period except Iraq and Qatar that shows decline in exports in until 3 –4 periods. The response of reserves to OP impulse has positive increase for Kuwait, Oman, Qatar, Saudi Arabia and U.A.E after 3rd period, while is declines for Iraq after 3rd period. The response of fiscal balance to *OP* impulse peaks in 1st period for Iraq, Kuwait, Saudi Arabia and U.A.E while Oman and Qatar show the peak fiscal balance response at 2nd period. The response is steady until 10th period. This indicates big response to fiscal structure of government's revenue collection. The response of GDP growth to *OP* impulse peaks in 1st period for Kuwait, Qatar, Saudi Arabia, U.A.E. But it has strange negative response for on Iraq and Oman in 1st period which later rises in 2nd period.

North Africa – (Algeria, Egypt, Libya)

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 10.1, 10.2 and 10.3 for Algeria, Egypt and Libya respectively (in Appendix F). The findings suggest that the response of exports to price impulse is positive for all countries from 1st period. Reserves shows positive response for 1st period in Egypt while Libya and Algeria economy has long term positivity in reserves from oil price hike and vice versa. The impulse response of exchange rate to price shock is negative for Egypt and Algeria for long period , implying the local currency appreciates. Meanwhile Libya exchange rate shows positive response to the impulse, so their currency depreciates to oil rise.

The response of fiscal balance to oil impulse is positive for 3 periods after which it stabilizes. Algeria fiscal response shows highest reliance on oil price for government's revenue collection. The response of *GDP* growth to oil price shock is negative from 2nd period onwards. Egypt and Libya show positive response for first 3 –4 periods, which stimulates their growth rates in oil price hike.

Latin America – **(**Brazil, Colombia, Ecuador, Mexico, Venezuela)

The impulse response (IRF) of macroeconomic variable indicates the response to one S.D. innovation of oil price shock for 10 period forecast horizon and are given in Figure 11.1, 11.2, 11.3, 11.4 and 11.5 for Brazil, Colombia, Ecuador, Mexico, Venezuela respectively (in Appendix G). The outcomes indicate the response of exports to oil price impulse is positive for all these countries for long periods. It indicates exports by value in USD increases from oil price hike. The reserves have positive effects for all countries except Ecuador. Long period stability in reserves shows that the economy can hold the incoming foreign reserves for many periods. The response of exchange rate to *OP* impulse is negative for Colombia and Mexico while its positive for Brazil and Venezuela which shows the local currency depreciates immediately against the USD and vice versa for Colombia and Mexico. The response of fiscal balance to *OP* impulse is positive for long period for Brazil and Colombia while rest of countries shows declines after 3 –4 periods. Implying the fiscal response is positive government revenue collection has large reliance on oil. The response of *GDP* growth to *OP* shock is immediate from the first period, which reveals an oil price shock makes the impact on the *GDP* growth of all countries. Mexico shows sharp decline in its 2nd period that means their declines growth and cannot sustain high oil price.

4.4. Variance decomposition

Lastly, variance decomposition test is employed to observe the oil price effect on the macroeconomic indicators. The forecasted variance decomposition analysis for the crude oil price, exports, foreign exchange reserves, nominal effective exchange rate, fiscal balance, and *GDP* growth over 10 years of time horizons are performed for each country and their results are averaged for next 10 periods horizons. In this way, average long-period impact of oil price shocks on all the selected variable are better determined for each individual country, while also finding the similarities between the countries with in the classified group.

Nomenclature

– *OP* – Oil price;

– *EXP* – Exports;

– *RES* – Reserves;

– *NEER/EXC* – Nominal effective exchange rate;

– *FisBal* – Fiscal balance (Revenues – Expenditures);

– *GDPg* – Gross domestic production annual growth.

Developed economies

The variance decomposition of the *EXP* shows that impulse in *OP* can explain about 64 % of variation in the *EXP* of Norway, the highest variance in developed oil exporting economies. Australia, Canada just 15 % and 20 % of variation from the decomposition are revealed. The variance decomposition of *RES* reveals that *OP* shock accounts for approximately 30 % of the variation for Norway, again the highest variation in this group. While, Canada 20 % and Australia 14 % variance respectively. The variance decomposition of *EXC* for Norway in reference to oil price shock explains approximately 35.5 % of variation in *EXC*. For Canada the effect in Nominal accounts for only 5.7 % variation which is assumed to be very stable. The variance decomposition of *FisBal* for Norway shows variation of 50.5 % as a result of an *OP* shock, this implies heavy oil dependency of Norway for its government expenditure and revenue collection from oil revenues. Lastly, the variance decomposition of *GDPg* implies that Canada has the highest variance, almost of which 22 % could be explained by the oil price impulse, followed by Australia and Norway between 12 –14 % variance.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Overall analysis concludes that Developed countries shows minimal response to oil price shock with the only exception being Norway, as its exports and fiscal balance are heavily dependent on oil revenues. Australia showed the least oil dependency from the variance decomposition and IRF outcomes.

Transitional economies

The variance decomposition of *EXP* reveals an oil price shock affect the economies of transitional countries heavily. For Russia, an oil price shock explains approximately 44.3 % of the variation in its *EXP*, followed by Kazakhstan and Azerbaijan with 42.6 % and 33.7 % variance response respectively. The variance decomposition of *RES* reveals an oil price shock affect the transitional economies in a similar fashion, between 20.5 % to 23 % variation. The variance decomposition of *EXC* illustrate an oil price impulse accounts for approximately 32 % of the variation for Kazakhstan, highest in the group, followed by Russian Federation and Azerbaijan with 27 % and 20.4 % variation respectively. The variance decomposition of *FisBal* for Russia shows high variation of 42.2 % as a result of an *OP* shock, this implies heavy oil dependency of Russia in government's revenue collection from oil sources. Azerbaijan has only 6.5 % variation on its Fiscal Balance as a response to oil price impulse. Lastly, the variance decomposition of *GDPg* shows an oil price shock explains about 45 % variation of Russia's economic growth, followed by Azerbaijan and Kazakhstan 27.2 % and 23 % variance respectively.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Overall findings conclude that the economies in transition have higher than average response to oil price shocks. Russian Federation indicators indicated extra reliance on exports,

government expenditure and revenue which stimulates its *GDP* growth. Findings suggest that Azerbaijan show the least oil dependency from the variance decomposition and IRF outcomes in this group.

Developing economies

Asia – **(**Brunei, Iran, Malaysia)

The variance decomposition of *EXP* reveal an oil price shock heavily affect Brunei and Iran exports. For Brunei an oil price shock explains approximately 81.5 % of the variation in *EXP*, followed by Iran 59.7 % and Malaysia just 12.7 % variation respectively. The variance decomposition of *RES* reveals that an oil price impulse affect Brunei reserves up to 73 % and Malaysia with 25 % variance. Iran's reserves are not taken in our analysis because of the U.S sanctions on its economy. Hence, Iran central bank does not reflect any data for foreign reserves. The variance decomposition of *EXC* reveals an oil price shock accounts for approximately 81 % of the variation for Brunei, highest variation in the group, followed by Iran 24 % and Malaysia under 14 % variation respectively. The variance decomposition of *FisBal* for Brunei shows high variation of 58 % as a result of an *OP* shock, this indicates its large oil dependency for oil revenues. Malaysian economy has only 12.7 % variation on the fiscal balance as a response to an *OP* shock. Lastly, the variance decomposition of *GDPg* elaborate an *OP* shock explains between 12 –18 % variation for the GDP growth of this group.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Findings tell that the developing Asian economies has different response to oil price shock. Brunei economies is heavily linked with crude oil exports, government's revenue that reflects its *GDP*g. Iran economy is also overwhelmingly dependent on oil commodity. Also, it reveals that Malaysia has the least oil dependency from the variance decomposition and IRF studies in this group.

Africa – **(**Angola, Congo Rep., Equatorial Guinea, Gabon, Ghana, Nigeria)

The variance decomposition of the *EXP* indicates that a shock in *OP* can explain about 85 % of variation in the *EXP* for Gabon, the highest in the region. Meanwhile, Ghana shows the least variation from the results of 37 % and rest of African countries reflects 63 –71 % variance from an external *OP* shock. In the variance decomposition of *RES, OP* impulse accounts for approximately 59 % of the variation for Congo Rep., the highest variation in the region, followed by Gabon, Angola, Equatorial Guinea and Ghana between 35 –45 % variance respectively. Nigeria shows minimal response to its *RES* of just 17.4 %. The variance decomposition of *EXC* reveals crude price shock accounts for an overwhelmingly 77 % of the exchange rate variation for Angola and over 42 % for Guinea. Other countries of the region have between 20 –30 % variance. Oil price impulse explains Congo. Rep. 43 % and Gabon 40 % *FisBal* variation. Fiscal response for Guinea, Nigeria and Angola ranges from 26 –34 %, while Ghana economy has 13 % variance to an *OP* shock. The variance decomposition of *GDPg* shows the overwhelming variance of Angola economy up to 72 % in *GDPg*

as a result of an oil price impulse. This Angola *GDP* growth is stimulated by higher oil prices and vice versa, followed by Ghana 37 % variance. Guinea, Nigeria, Congo Rep. and Gabon shows the least *GDPg* variance of just 9 –13 % to an *OP* Shock on their *GDP* growth.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Overall analysis concludes that the developing economies in Africa has oil reliance to their *GDP*. However, it should be mentioned that Angola and Congo are the most heavily oil dependent country in this region from outcome of this analysis. Ghana economy shows the least response to external *OP* shocks from the variance decomposition and IRF outcomes.

Middle East – **(**Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates)

The variance decomposition of the *EXP* indicate OP shock explains about 85 –89 % of variation for Kuwait and Iraq exports, which is not only highest in this region but also the most in all the analysis of oil exporting countries. Oman, Qatar, Saudi Arabia reflects 52 –64 % of variation from the analysis, and U.A.E has the least variance in *EXP* of 37 % in this region. The variance decomposition of *RES* reveals that *OP* shock accounts for approximately 69 % of Iraq variance, highest in the region followed by Oman, Saudi Arabia and Kuwait between 43 –56 % variance respectively. Qatar and U.A.E has minimal response to their *RES* to *OP* shock, between 19 –22 % variance. The variance decomposition of *FisBal* in response to oil price impulse explains approximately 72 % of Iraq's fiscal balance variation. Higher the *FisBal* response to *OP*, more is the dependence on oil revenue for government. *FisBal* response for Kuwait, Oman and Saudi Arabia ranges from 55 –59 % respectively, while Qatar economy has 39 % and U.A.E 33 % *FisBal* variation respectively to *OP* shock. The variance decomposition of *GDPg* shows the overwhelming variance of Iraq about 63 % as a result of an oil price shock, this implies the overall *GDP* of Iraq revolves around oil income. Kuwait showed the least *GDPg* variance of just 17 %, while the rest of counties responded between 27.5 –31 % variation to crude shock.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Overall analysis concludes that developing countries of the Middle East has extra ordinary reliance to oil incomes. However, it must be mentioned that Iraq and Kuwait are the two most heavily oil dependent country in the global economies. U.A.E economy showed the least to external *OP* impulse from the variance decomposition and IRF outcomes.

North Africa – (Algeria, Egypt, Libya)

The variance decomposition of *EXP* reveals *OP* accounts for approximately 75.6 % of the variation in *EXP* for Libya, followed by Algeria 47.5 % and Egypt 28.5 % variation respectively. The variance decomposition of *RES* reveals an *OP* impulse affect Libya's reserves by 44.5 %, Algeria by 21 % and Egypt by 12 % respectively. The variance decomposition of *EXC* reveals an *OP* shock heavily effect national currency of Egypt and Libya by 56.7 % and 37 %, while Algeria *EXC* response

only 11% to *OP* shocks. The variance decomposition of *FisBal* for an *OP* shock could explain 52% of the variation for Algeria, highest in the region, Egypt's *FisBal* has only 11 % variation to an *OP* impulse. Now the variance decomposition of *GDPg* showed an *OP* shock explain 35 % of Libya GDP growth is stimulated by crude oil, while the effects are minimal for Algeria, just 8 % variance is recorded from the analysis.

The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Result concludes developing North African economies has different response to *OP* shock. Libya and Algeria economies showed large reliance crude oil economy, while Egyptian economy has the least oil dependency in this group.

Latin America – **(**Brazil, Colombia, Ecuador, Mexico, Venezuela)

The variance decomposition of the *EXP* tells an *OP* impact explains about 75 % of Venezuela exports variation, followed by Ecuador 69 %, Colombia 60 % and Mexico 35%. *RES* response to the oil price shock accounts for approximately 57 % variation for Colombia, highest in the region for reserves that reveal its reserve vulnerability to crude sales, followed by Mexico with 31 %, Venezuela 19 %, Ecuador 15 % and Brazil 9.4 % variance respectively. The variance decomposition of *EXC* in reference to oil price shock explains approximately 66% of Colombia variation. The effect in exchange rate to oil impulse accounts for 27 % on Venezuela, 13 % on Mexico and only 3 % on Brazil. The *EXC* for Ecuador is not used in the analysis, as the government adapted the U.S dollar as their currency from year 2000 onwards. The variance decomposition of *FisBal* for Colombia, Ecuador, Venezuela shows high variation of 42 –50 % as response to *OP* shock. This implies heavy oil dependency in government revenue collection, while its only 21 % variation for Mexico. Lastly, the variance decomposition of *GDPg* implies that, Ecuador has 47.5% variation that could be explained by the *OP* impulse, followed by Colombia 42 %, Venezuela 20 % and Mexico 15.5 % variance respectively. The *GDPg* of Brazil is not impacted by the external *OP* impulse as the outcome suggest only 6.5 % variance in the *GDPg*.

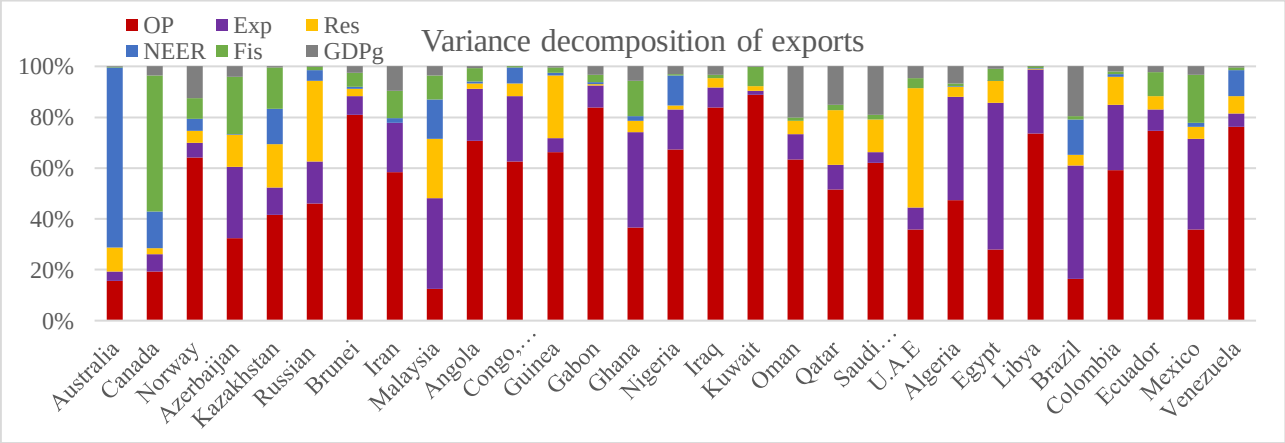
The outcomes of the decomposition test are in line with the findings of impulse response functions (IRFs). Overall analysis implies that developing countries of Latin America shows oil economy, with the only exception being Brazil, because of its diverse economy compared to the rest of Latin economies as shown from the variance decomposition and IRF outcomes.

Summary from the empirical analysis

The impacts of individual countries within the group are averaged to compare the trends of intra-group for the macroeconomic variables. The results of developing countries were assessed in subgroups.

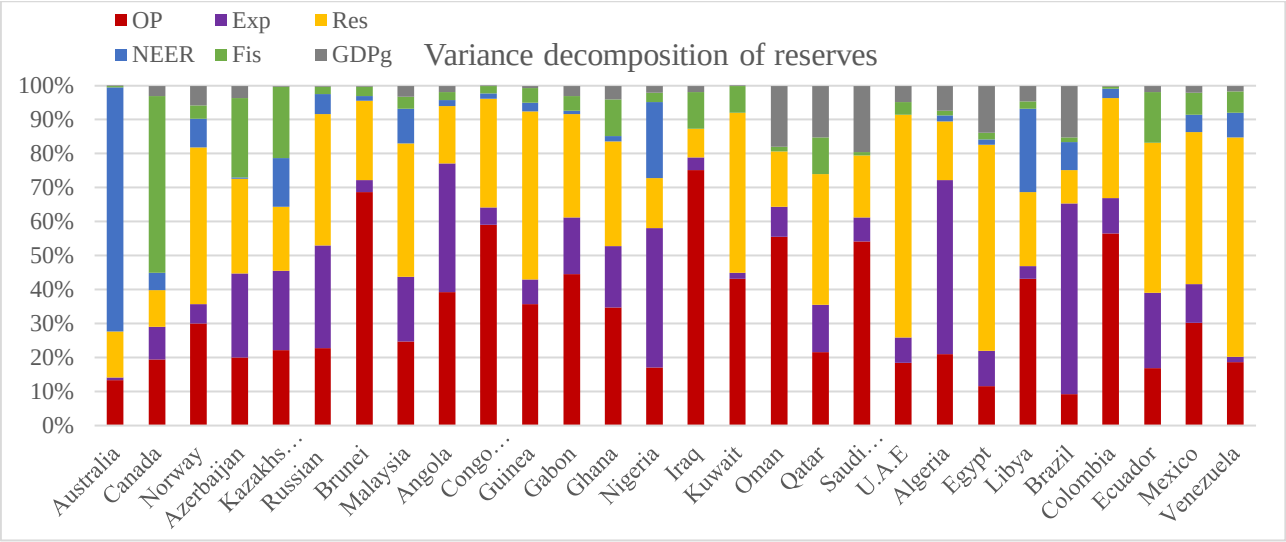
The results prove the previous literature results that macroeconomic variable of the developed economies are the least impacted to oil price fluctuations, with the obvious exception being Norway

that shows large presence of oil economy on its GDP. The economies in transition have huge influence of oil price shocks on their economic growth, exports and fiscal structure of the government revenue. While, the developing economies of Africa, Middle East and Latin America shows very significant presence of oil to its export and fiscal balance. It also shows that developing countries has a negative impact on their local currency that also confirms the previous findings from literature. The highest exchange rate impacted groups are economies from Latin America and African countries. When oil price increases, it appreciates the exchange rate short period from the analysis but the effects are not long lasting and the currency starts depreciate when oil price stabilizes. The foreign reserves of the developing economies are affected in all developing countries, while the highest variance is shown in Asia and Middle East. The findings of this paper indicates that the revenue-surplus for the government from oil prices hike helped them to stimulate the growth rate, reduced fiscal deficit, increase exports, increase foreign cash inflow and strengthen the local currency. From the findings its seen that positive oil shocks cause faster growth in government spending far more than anticipated, following higher than expected budget surplus after favorable fiscal conditions. The classification of economies shows that the fiscal balance of the governments of developing economies specially from Middle East and Latin America indicate an overwhelmingly reliance on oil revenue for their expenditure, as shown by the variance decomposition analysis. Middle East and Latin American economies are the most vulnerable to oil price shocks, while developed countries showed the least contribution of oil to their *GDPg* and fiscal structure followed by economies in transition, Asia and North African economies. Most of the developing economies are not diversified enough and oil shares a large part in their overall *GDP*, thus majority of the government income comes from the oil economy and non-oil economy contributes a very little to the progressive growths in *GDP* and tax collection. The variance decomposition on five macroeconomic variable by impact of oil (red), exports (purple), reserves (yellow), exchange rate (blue), fiscal balance (green) and GDP growth (grey) is shown in figure 4.1, 4.2, 4.3, 4.4 and 4.5 over next pages.



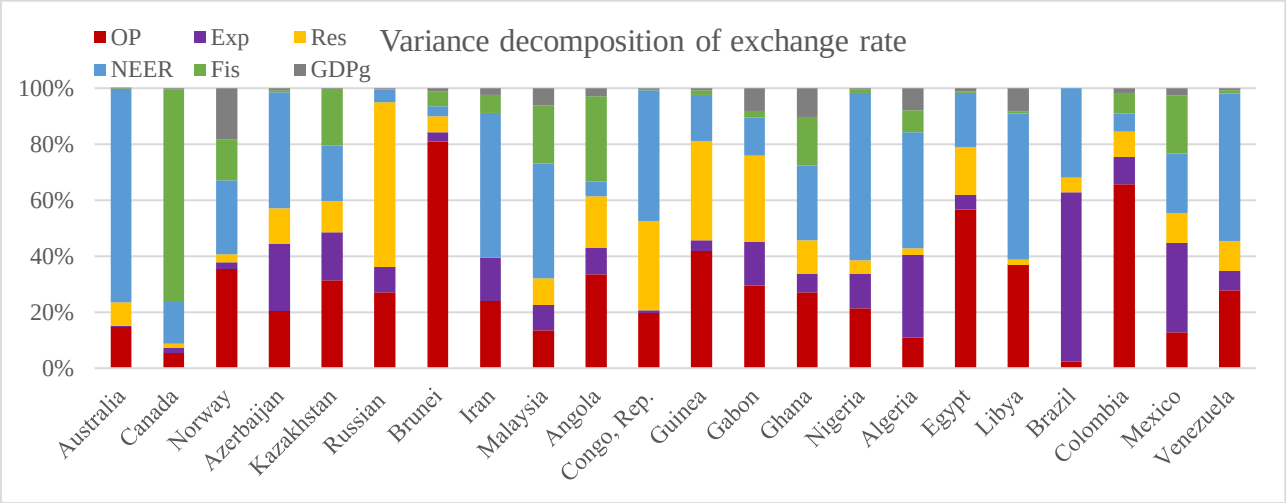
Source: Compiled by the author from variance decomposition results for oil exporting economies

Figure 4.1 – Variance decomposition of exports to oil price shock for 10 periods average



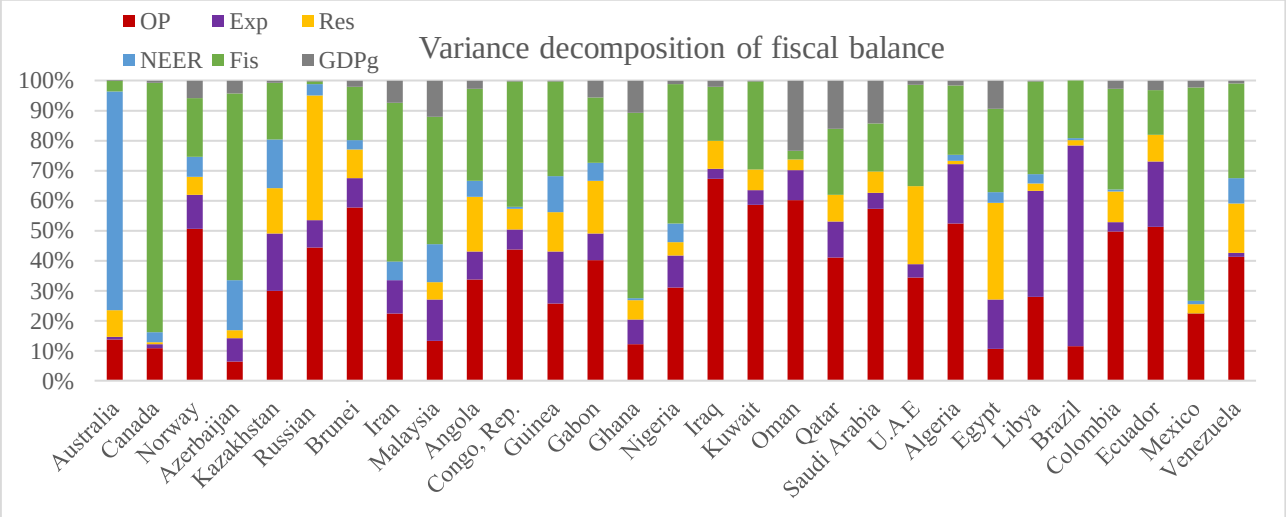
Source: Compiled by the author from variance decomposition results for oil exporting economies

Figure 4.2 – Variance decomposition of reserves to oil price shock for 10 periods average



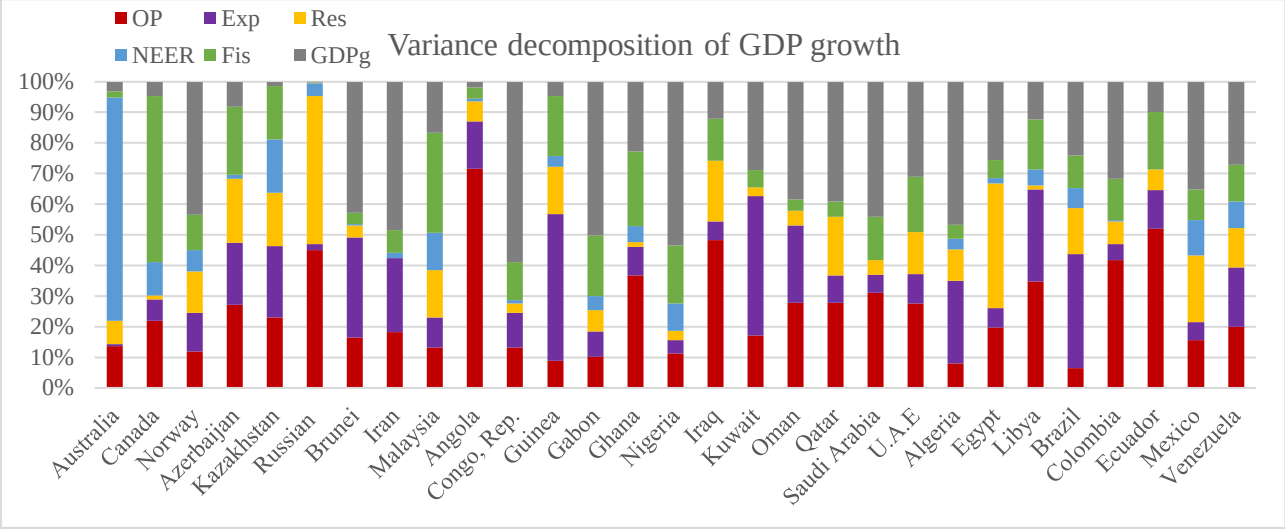
Source: Compiled by the author from variance decomposition results for oil exporting economies

Figure 4.3 – Variance decomposition of reserves to oil price shock for 10 periods average



Source: Compiled by the author from variance decomposition results for oil exporting economies

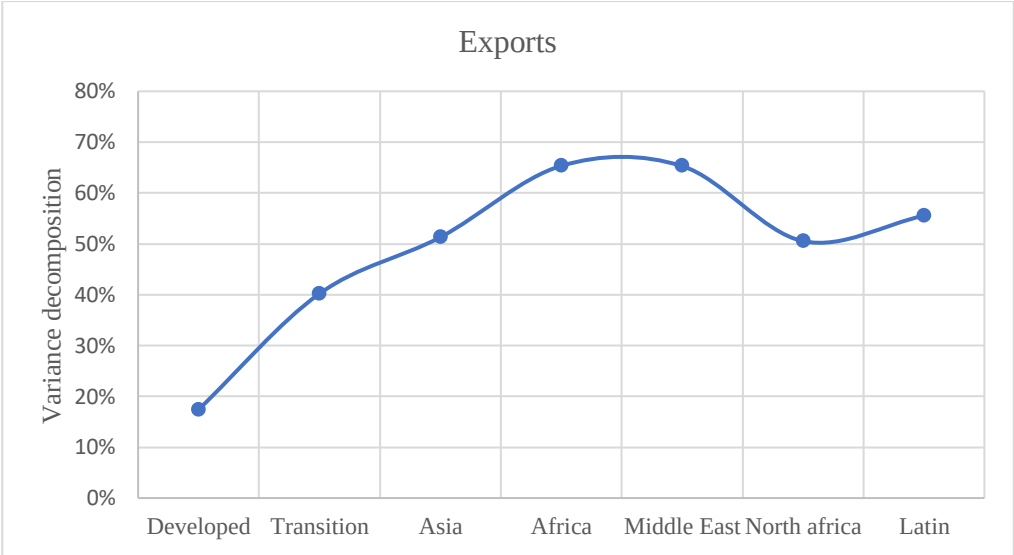
Figure 4.4 – Variance decomposition of fiscal balance to oil price shock for 10 periods average



Source: Compiled by the author from variance decomposition results for oil exporting economies

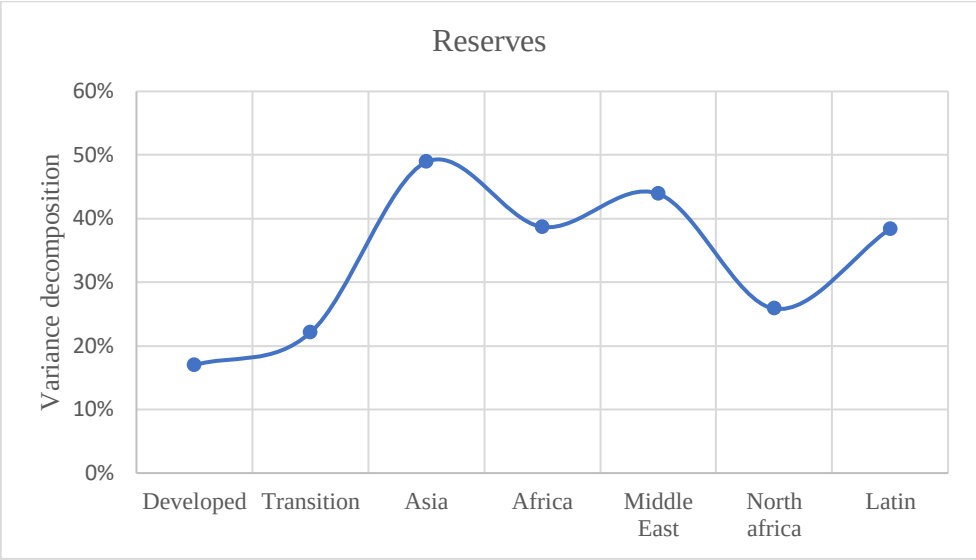
Figure 4.5 – Variance decomposition of *GDP* growth to oil price shock for 10 periods average

The reliance of developing economies on a single commodity for their export revenues trigger a vulnerability in the economy in long term. Low oil prices have impacted many exporters with budget problems which makes a risk to the stability of the economy. Recent oil price slump has indicated that many governments have had large budget deficits right after the pandemic started. That also disturbed the future budget targets as the oil price is very uncertain in this period. The average variance decomposition outcome of each classified group is represented in figure 5.1, 5.2, 5.3, 5.4 and 5.5 for the exports, foreign reserves, nominal exchange rate, fiscal balance and *GDP* growth respectively. Norway is dropped from the average results of developing countries, Brazil is separated from the average results of developing Latin American region in order to separate economies that are vastly deviating from the rest of group to get better average results for intra-group comparisons.



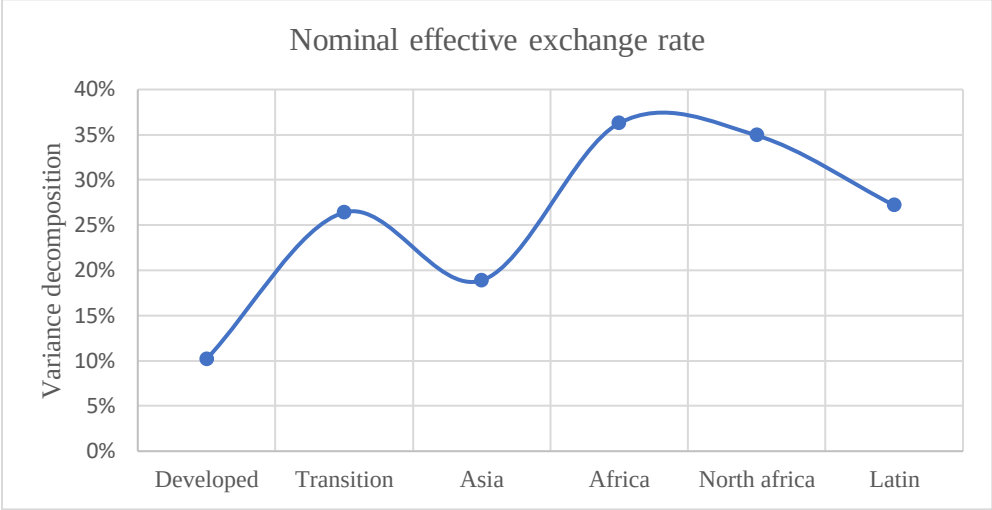
Source: Compiled by the author, variance decomposition of EXP to OP shock

Figure 5.1 – Average variance decomposition of exports in all regions



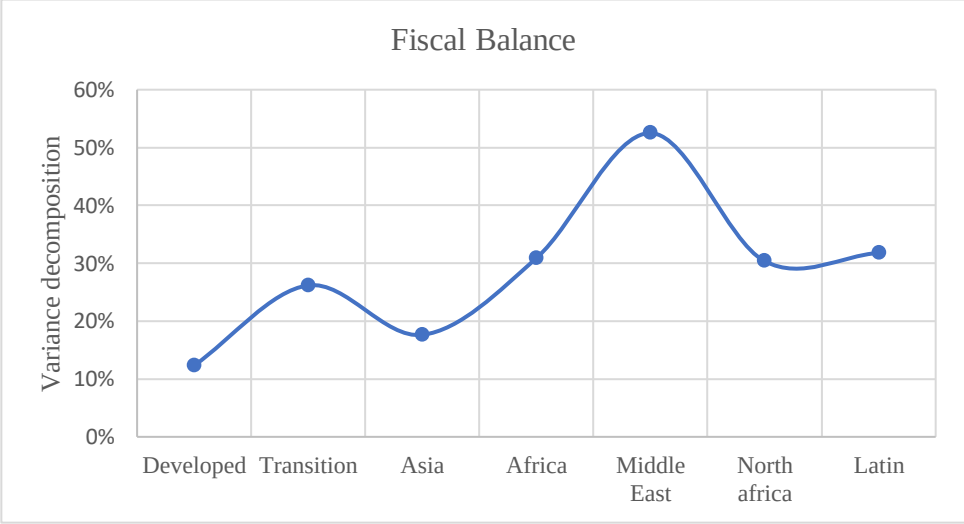
Source: Compiled by the author, variance decomposition of RES to OP shock

Figure 5.2 – Average variance decomposition of reserves in all regions



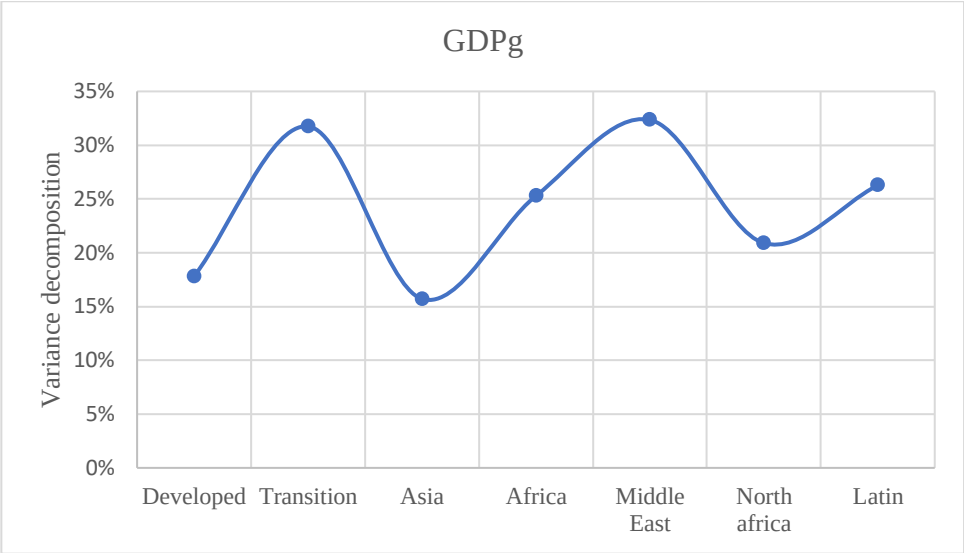
Source: Compiled by the author, variance decomposition of NEER to OP shock

Figure 5.3 – Average variance decomposition of exchange rate in all regions



Source: Compiled by the author, variance decomposition of FisBal to OP shock

Figure 5.4 – Average variance decomposition of fiscal balance in all regions



Source: Compiled by the author, variance decomposition of GDPg to OP shock

Figure 5.5 – Average variance decomposition of GDP growth in all regions

The fact that developing countries are heavily impacted by a decreased in oil prices in year 2008, 2014 and 2020. Overall, the economies of the oil exporting countries prosper in the first decade of the country until 2008 as the oil price continued to growth until the global recession, which was reflected in growth in the GDP and governments spending. However, after the slump of oil prices, many developing countries faced fiscal deficits and had to cut subsidies to cut their spending after falling revenues in the budget financing. Many economies still have not recovered from the massive impact of the oil price fall as several measures to improve their economies were not taken at the right time.

During the lockdown globally after COVID-19, world industrial production was standstill, vehicles consumption of fuel ceased due to work from home and online education policies. The pandemic has exposed the vulnerability of energy exporting countries, as the demand for fuel was absent for many months. Such deterioration of the economy poses serious risk for developing oil exporting country's economic growth, after examining the aftershocks of the global economic recession. As weak growth lessens the private investment and consumption in the economy and hardly impacts the labor market. Thus, the economic slowdown makes the pace of the *GDP* growth to decrease.

Recommendation

Oil price must be maintained at a desirable level that is favorable for the entire global economy. It is seen from the previous price slumps that whenever oil price reach new heights, the emerging economies that required imported oil for their energy needs comes to a stand-still. As high oil prices make not favorable environment for growth in emerging market, from where most of oil demand growth is coming every year. Since OPEC group contributes a major share of oil supply, OPEC can

adjust the oil price if they are unsatisfied with it, by cutting oil production for the price to rise. However, no individual country wants to cut its own supply as lowering the supply implies reduced revenues. Thus, each member of OPEC group should reduce certain amount of production according to their quota system to smoothen the collateral damage. Long term politics for sustainable oil price that suits the emerging economies as well is required for the long-run benefits of global energy suppliers, rather than gaining short period profit gain from price hikes. When oil prices are too high to the point that it starts to affect consumers budget, oil demand will start to shrink and the global economy could face another recession due to inflations cause by crude price hike. Consequently, from the study of past price hikes it could be seen that hike in oil price is followed by a slump due to shrinking demands. Thus, longevity in stable oil price around $70 –$80/barrel is needed for oil producing countries to build a sustainable capital investment for the diversification of the economy. Instead of making all the policies around the oil economy, more productivity and new thinking is required for the enhancement of performance in the non-oil economy, especially for developing and transitional oil exporters. For instant, the fiscal damage done to the government budget can be lowered, if the developing economies from the Middle East, North Africa and Africa can expand their taxation base. Some countries in the Middle East have 0 % income tax and very low corporate tax, this is the area in which the policymakers can look at to reduce the fiscal deficits cause by energy price shocks to act as an absorber in uncertain situations. So, the energy exporting economies must raise their non-oil tax revenues to balance the tax collection in lower oil price environment.

To reduce economic uncertainties in business cycles, policymakers in the government needs immediate structural changes for the policy shift to diversify their oil reliance *GDP* and thoroughly transform their exports to boost an alternate non-oil revenue section to cushion the effect of oil price shocks. Moreover, by saving the government surplus revenues and cutting overspending to protect the economies from future oil prices shock. Also, the investment in job creation and to make skillful labor for alternative prevention measures. Lastly, developing countries should privatize the government institutes and make policies for foreign investments in non-oil sectors to minimize the overwhelming oil-oriented economies.

CONCLUSION

This paper investigated the impact of oil price shocks on the macroeconomic variable. The paper began was some brief introduction and objectives to be achieved at the end of this research. The works by previous authors in their literature was thoroughly investigated and the findings were studied from their literature. It was found from previous literatures, the topic for oil price impacts on oil exporting economies was hardly covered, while most of the findings were restricted to exchange rates. Thus, the paper chooses to study the impacts on other variables of the macroeconomy that deals the governments directly i.e., fiscal structure of the government that deals with the revenue collection and budgetary deficits. Furthermore, the paper investigated the previous oil price shocks from history and found the reasons for the price shocks according to previous authors and oil price determination mechanism in history. After that, the next objective of this paper was to find and build the best suited methodology for the aim of this paper. By carefully reading the previous literature models and SVAR method was chosen for this objective. Key macroeconomic variables were selected after examining the variables from other literatures, few new variables were taken in our model building such as, exports (*EXP*), foreign reserves (*RES*), nominal exchange rate (*NEER*), fiscal balance (Fis*Bal*), *GDP* growth (*GDPg*), while oil price is treated as an exogenous variable in the SVAR matrix. Twenty-nine biggest oil exporting countries in terms of exports in USD, were chosen for this model. The countries were classified according to UN developed status of a country. Hence, developed, transitional and developing economies are dealt in the paper. The data was collected from free online sources available by world bank, WTO and IMF. For the investigation, three decades period is selected from 1991–2020. Afterwards, empirical analysis is performed that includes four test: unit root test, lag criteria test, impulse response and variance decomposition. The outcome of the analysis showed that crude oil export revenue plays a vital role in the government budget financing for many oil exporting economies. The government decisions for its investment, development projects and spending on common people in developing and transitional economies are highly affected by the uncertainty in oil price. This paper investigated the impact of oil price shocks on a fundamental variable of the government that is the fiscal balance. The variable is an indicator of the expenditures and revenue difference of the government. Hence, low fiscal deficit indicates the government is meeting its expenditure through a healthy revenue inflow. Meanwhile for oil exporting countries, the revenues are highly affected by fluctuations in international crude oil market. Hence, all the governments of these economies are affected due to such varying foreign currency inflow. Lastly, some recommendations are suggested for the investigated countries. Future research could further develop this study by including monthly and quarterly data. Then comparing whether the impact of crude price shocks on major oil exporters are similar. The post pandemic impact could be better analyzed by future research, as they will be accessed to more data for couple of years ahead from today.

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APPENDIXES

Appendix A

Developed Economies

Australia

Table 5.1 – Unit root test of Australia

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.2917	0	-4.3594*	0	-1.4909	-4.3594*	-1.4749	0	-4.5241*	0
Reserves	-2.9829	0	-6.4534*	0	-3.1210	-8.3221*	-2.9171	0	-6.0399*	0
NEER	-2.0883	1	-3.7384**	0	-1.7364	-3.6895**	-2.1768	1	-3.8316*	0
Fis-Bal	-1.3788	2	-3.2283	1	-1.1120	-2.3444	-1.5112	2	-3.2611**	1
GDPg	-3.9948	0	-5.9683*	0	-7.4948	-6.6502*	-3.0444	0	-6.1101*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 5.2 – Lag interval tests of Australia

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-84.98441	NA	2.68e-05	6.498887	6.784359	6.586158
1	38.37470	185.0387	5.57e-08	0.258950	2.257257*	0.869853
2	89.60847	54.89333*	2.79e-08*	-0.829177*	2.881965	0.305356*

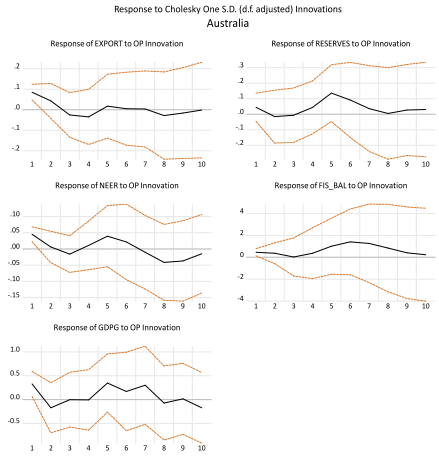
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 5.3 – Variance decomposition of Australia (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.81	**14.69**	3.52	8.81	66.6	0.35	0.09
Res	0.3	**13.9**	0.8	14.07	74.45	0.42	0.1
NEER	0.4	**14.64**	0.55	8.41	76.08	0.34	0.01
Fis	0.18	**13.82**	0.8	8.96	72.86	3.49	0.07
GDPg	4.28	**13.71**	0.52	7.76	72.87	2.06	3.08

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 6.1 – Impulse response function of Australia

Canada

Table 5.4 – Unit root test of Canada

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.4610	0	-5.2837*	1	-1.0057	-13.003*	-1.6110	0	-5.3997*	0
Reserves	-2.4504	0	-6.9915*	0	-2.9064	-7.1263*	-2.3793	0	-4.7906*	0
NEER	-1.9397	1	-3.0857	0	-1.7828	-3.1080	-1.9559	0	-3.1425***	0
Fis-Bal	-0.7516	0	-2.0038	0	-0.8656	-1.8990	-1.2853	0	-2.5892	0
GDPg	-3.5944	0	-5.3360*	0	-2.9589	-5.6379	-3.3365	0	-5.0263*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 5.5 – Lag interval tests of Canada

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-74.77061	NA	1.29e-05	5.769329	6.054801	5.856601
1	66.47138	211.8630	7.49e-09	-1.747956	0.250351	-1.137053
2	139.5397	78.28754*	7.88e-10*	-4.395696*	-0.684555*	-3.261164*

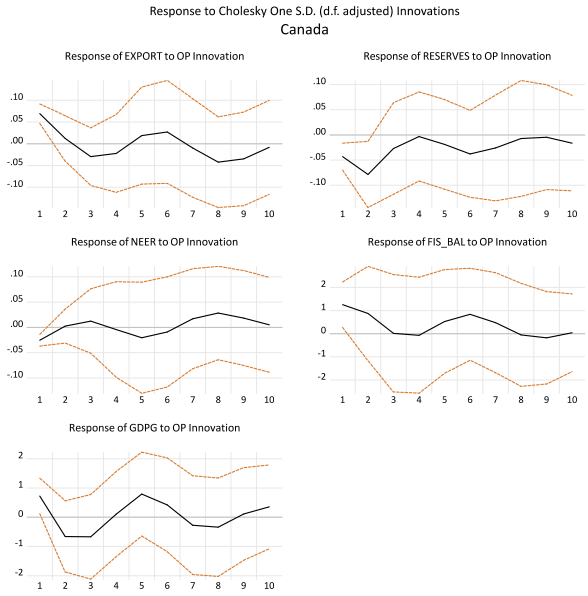
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 5.6 – Variance decomposition of Canada (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	1.09	**20.13**	7.03	2.33	14.96	55.75	3.63
Res	0.24	**20.07**	9.92	11.04	5.24	53.73	3.11
NEER	0.25	**5.73**	1.84	1.61	15.71	78.54	0.52
Fis	0.26	**10.85**	1.39	0.69	3.34	82.93	0.85
GDPg	5.57	**21.9**	6.93	1.44	10.86	54.26	4.61

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 6.2 – Impulse response function of Canada

Norway

Table 5.7 – Unit root test of Norway

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.5509	0	-4.8664*	1	-0.4702	-4.8245*	-0.9624	0	-4.9603*	1
Reserves	-2.5090	0	-6.6913*	0	-2.4549	-6.7394*	-2.4713	0	-6.3821*	0
NEER	-1.6310	1	-3.8549*	0	-1.2496	-3.8123*	-1.8286*	1	-3.9801*	0
Fis-Bal	-0.6912	0	-5.0720*	2	2.2624	-3.541***	-1.1956	0	-4.8909*	1
GDPg	-3.6990	0	-6.698314	0	-3.6916	-8.3872*	-3.8060	0	-6.8711*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 5.8 – Lag interval tests of Norway

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-88.06618	NA	3.34e-05	6.719013	7.004485	6.806285
1	41.79309	194.7889*	4.36e-08	0.014779	2.013086*	0.625681
2	86.15842	47.53429	3.57e-08*	-0.582745*	3.128397	0.551788*

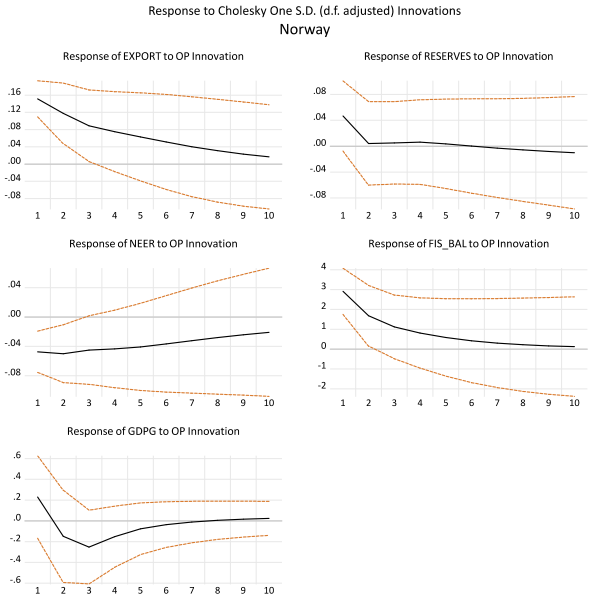
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 5.9 – Variance decomposition of Norway (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.44	**64.24**	5.69	4.61	4.88	8.06	12.51
Res	0.31	**29.96**	5.75	46.14	8.44	4.01	5.71
NEER	0.19	**35.55**	2.25	2.87	26.46	14.46	18.41
Fis	0.16	**50.53**	11.31	6.14	6.57	19.53	5.93
GDPg	5.65	**11.84**	12.66	13.5	7.07	11.54	43.39

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 6.3 – Impulse response function of Norway

Appendix B

Transitional Economies

Azerbaijan

Table 6.1 – Unit root test of Azerbaijan

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.0833	1	-3.1071***	0	-1.3752	-2.8587	-1.5167	1	-3.0097***	0
Reserves	-4.2521	0	-4.2501*	0	-4.5921	-4.2229**	-2.4086	0	-4.4290*	0
NEER	-14.709	1	-17.767	1	-5.8698	-3.2379**	-2.3480	2	-3.4233**	0
Fis-Bal	-3.1486	0	-4.7934*	1	-3.0147	-8.1123*	-3.3092	0	-5.4777*	0
GDPg	-2.5787	1	-5.0372*	0	-1.6415	-7.2162*	-2.7592	0	-3.7937*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 6.2 – Lag interval tests of Azerbaijan

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-187.3375	NA	0.400311	16.11146	16.40597	16.18959
1	-69.28652	167.2389	0.000477	9.273877	11.33547*	9.820818
2	-13.29641	51.32426*	0.000177*	7.608034*	11.43671	8.623783*

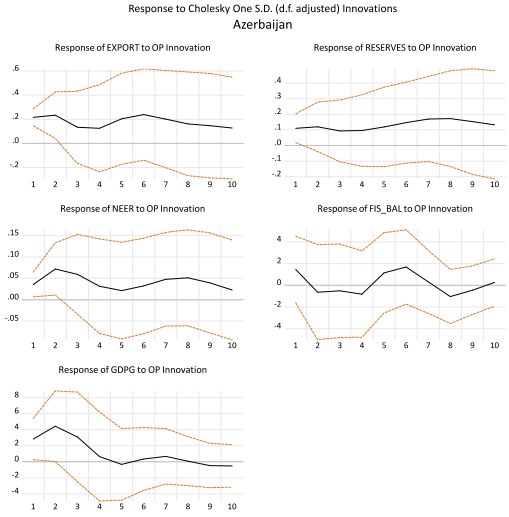
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 6.3 – Variance decomposition of Azerbaijan (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.51	**33.7**	29.39	13.03	0.24	23.55	4.19
Res	0.84	**20.51**	25.45	28.64	0.51	23.95	3.75
NEER	0.6	**20.37**	24.11	12.7	41.46	0.8	0.71
Fis	0.25	**6.48**	7.77	2.63	16.65	62.51	4.39
GDPg	9.19	**27.18**	20.32	20.86	1.33	22.2	8.12

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 7.1 – Impulse response function of Azerbaijan

Kazakhstan

Table 6.4 – Unit root test of Kazakhstan

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.6428	0	-4.5368*	0	-0.7006	-4.4928*	-0.9827	0	-4.6607*	0
Reserves	-0.7183	0	-6.6536*	0	-0.6119	-6.4995*	-0.9729	0	-6.7716*	0
NEER	-2.5416	0	-4.7362*	0	-2.6423	-4.7268*	-2.0336	0	-4.0074*	0
Fis-Bal	-3.8465	2	-3.9498**	2	-2.0231	-2.8976	-4.0155	2	-4.2215*	2
GDPg	-1.2825	2	-6.9535*	1	-0.5486	-5.7735*	-1.0720	2	-7.0143*	1

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 6.5 – Lag interval tests of Kazakhstan

		Information Criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-58.66314	NA	8.12e-05	7.607428	7.901503	7.636659
1	40.23523	116.3510*	6.77e-08*	0.207620*	2.266147*	0.412241*

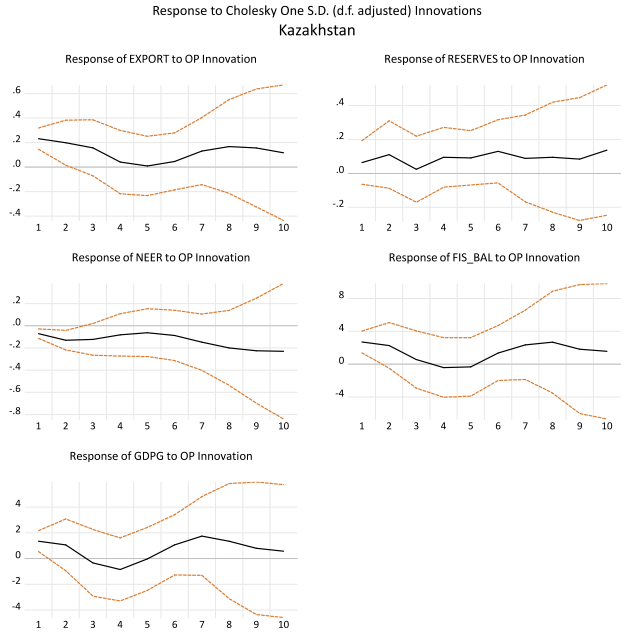
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 6.6 – Variance decomposition of Kazakhstan (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	1.7	**42.6**	11.16	17.44	14.21	16.65	0.37
Res	1.01	**22.68**	23.69	19.18	14.63	21.24	0.38
NEER	0.93	**31.79**	17.27	11.21	20.15	20.45	0.15
Fis	1.44	**29.89**	19.26	15.08	16.08	19.01	0.72
GDPg	16.38	**23.08**	23.22	17.55	17.28	17.49	1.39

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 7.2 – Impulse response function of Kazakhstan

Russian Federation

Table 6.7 – Unit root test of Russian Federation

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.9767	0	-4.4730*	0	-1.0427	-4.4187*	-1.2465	0	-4.6296*	0
Reserves	-0.9669	0	-6.0052*	0	-0.8961	-5.9033*	-1.1439	0	-5.5533*	0
NEER	-4.7276	1	-3.1162	0	-2.7257	-3.1396	-1.5426	1	-3.2501*	0
Fis-Bal	-3.0630	1	-3.9507**	0	-3.1381	-4.6787*	-3.0428	1	-3.8790*	0
GDPg	-2.4738	0	-8.2648*	0	-2.3097	-21.607*	-2.6205	0	-7.3079*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 6.8 – Lag interval tests of Russian Federation

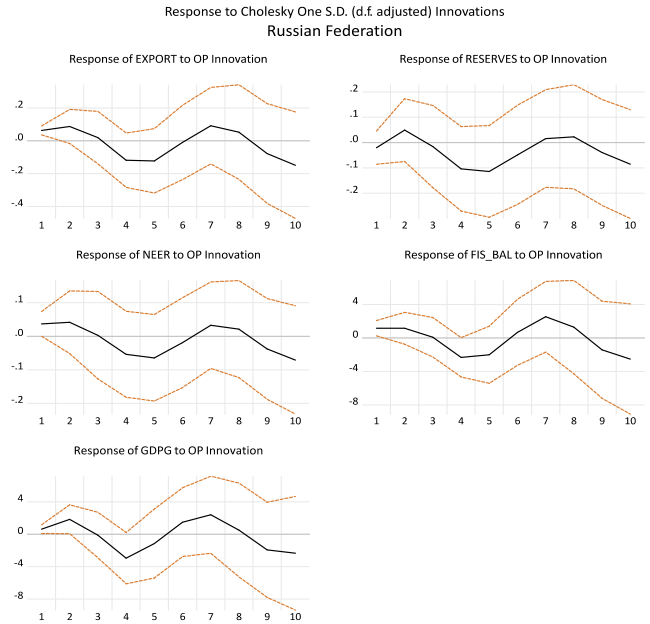
		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-80.53561	NA	0.000231	8.653561	8.952280	8.711874
1	54.90270	176.0698	1.33e-08	-1.290270	0.800768	-0.882077
2	144.5884	62.77999*	2.32e-10*	-6.658839*	-2.775484*	-5.900768*

Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 6.9 – Variance decomposition of Russian Federation (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.81	**44.30**	15.71	30.56	4	1.25	0.21
Res	0.73	**23.04**	30.46	38.98	5.77	2.24	0.32
NEER	1.28	**27.06**	9.07	58.8	4.58	0.38	0.15
Fis	0.83	**42.16**	8.62	39.55	3.6	0.86	0.2
GDPg	24.83	**44.99**	1.95	48.42	4.194	0.21	0.21



Source: Compiled by the author

Figure 7.3 – Impulse response function of Russian Federation

Appendix C

Asian region

Brunei

Table 7.1 – Unit root test of Brunei

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.2206	0	-4.3886*	0	-1.3984	-4.3195**	-1.3750	0	-4.4622*	0
Reserves	-1.9017	2	-2.0976	1	-2.0460	-3.3897***	-2.4136	2	-1.8598	1
NEER	-2.2038	1	-3.3195***	0	-1.8270	-3.3055***	-2.3050	1	-3.3327**	0
Fis-Bal	-2.3172	0	-5.4500*	1	-2.3093	-7.5826*	-2.4300	0	-6.8409*	0
GDPg	-4.3852	1	-5.7897*	2	-5.2466	-9.6021*	-4.5549	1	-5.3590*	2

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 7.2 – Lag interval tests of Brunei

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.81933	NA	3.93e-05	6.881933	7.180653	6.940247
1	20.08840	107.7801	4.34e-07	2.191160	4.282198	2.599352
2	102.9995	58.03780*	1.49e-08*	-2.499954*	1.383402*	-1.741882*

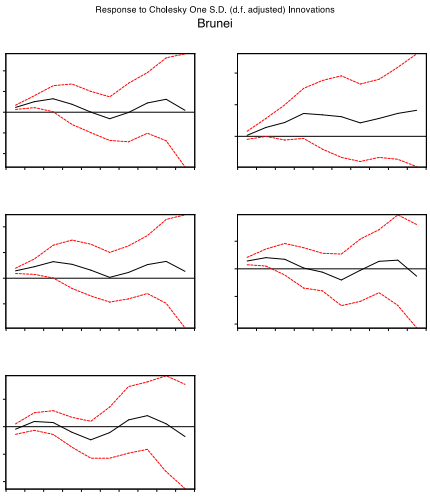
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 7.3 – Variance decomposition of Brunei (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.69	**81.46**	7.37	2.77	0.82	5.66	2.51
Res	0.41	**72.8**	3.71	24.88	1.49	2.81	0.37
NEER	0.67	**81.23**	3.33	5.64	3.56	5.31	1.26
Fis	0.11	**57.77**	9.7	9.55	3.23	17.76	2.08
GDPg	15.35	**16.51**	32.6	3.95	0.51	3.7	42.74

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 8.1 – Impulse response function of Brunei

Iran

Table 7.4 – Unit root test of Iran

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.8087	0	-4.7728*	0	-0.9378	-4.7735*	-1.1890	0	-4.9580*	0
NEER	-3.8195	0	-5.5550*	0	-5.1325	-5.5429*	-2.8929	0	-5.6092*	0
Fis-Bal	-3.8671	1	-6.3810*	1	-3.2180	-10.242*	-3.9555	1	-6.6953*	1
GDPg	-4.9406	0	-6.1649*	1	-4.9615	-17.799*	-4.6994	0	-5.9676*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 7.5 – Lag interval tests of Iran

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-188.1441	NA	0.674876	13.79601	14.03390	13.86873
1	-116.8817	111.9838*	0.025627*	10.49155	11.91891*	10.92791*
2	-91.51345	30.80431	0.030168	10.46525*	13.08208	11.26524

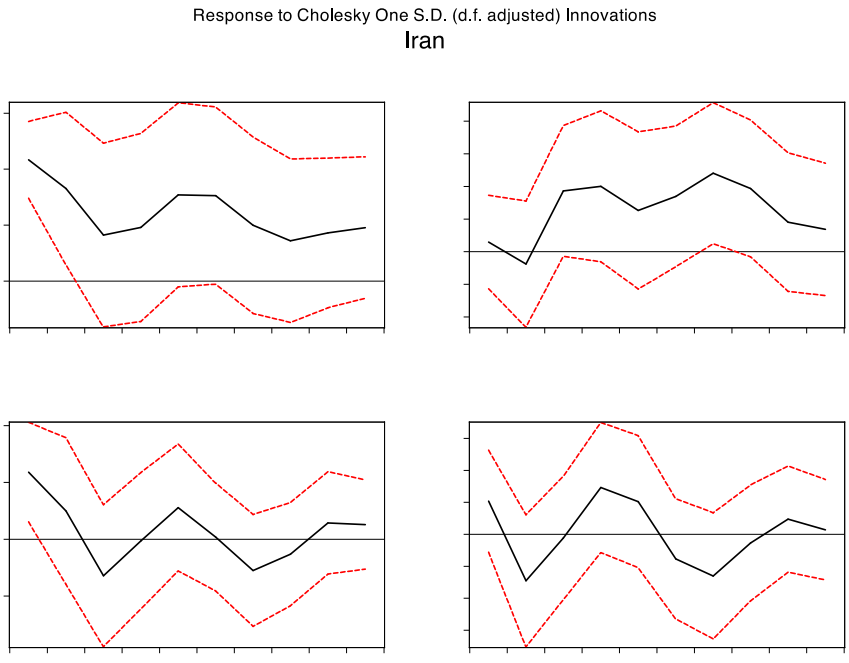
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 7.6 – Variance decomposition of Iran (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*NEER*	*Fis*	*GDPg*
Exp	0.48	**59.73**	19.77	1.95	11.11	9.73
NEER	0.44	**24.12**	15.81	51.98	6.56	2.44
Fis	0.62	**22.51**	11.25	6.25	53.23	7.51
GDPg	3.17	**18.15**	24.32	1.65	7.49	48.39

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 8.2 – Impulse response function of Iran

Malaysia

Table 7.7 – Unit root test of Malaysia

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-2.0325	0	-5.1823*	0	-1.9444	-7.4672*	-1.7947	0	-5.3623*	0
Reserves	-1.6201	0	-4.3497*	0	-1.8555	-4.3178**	-1.5355	0	-4.1382*	0
NEER	-1.6729	0	-4.2260*	0	-1.6729	-4.1516**	-1.7344	0	-4.2159*	0
Fis-Bal	-1.8686	0	-4.5899*	0	-1.9688	-4.5850*	-1.9388	0	-4.7156*	0
GDPg	-4.6027	0	-6.323751*	1	-4.5993	-9.2266*	-4.6423	0	-5.8414*	1

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 7.8 – Lag interval tests of Malaysia

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-113.9739	NA	0.000212	8.569561	8.855034	8.656833
1	16.99299	196.4503	2.57e-07	1.786215	3.784521*	2.397117
2	66.98291	53.56062*	1.40e-07*	0.786935*	4.498076	1.921468*

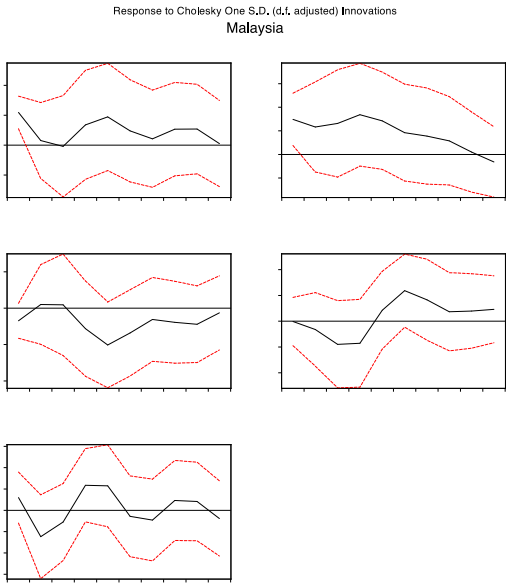
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 7.9 – Variance decomposition of Malaysia (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.64	**12.73**	36.62	24.06	15.87	9.66	3.72
Res	0.2	**24.98**	19.12	39.64	10.27	3.64	3.2
NEER	0.32	**13.65**	9.15	9.85	41.41	21.09	6.21
Fis	0.14	**12.75**	13.09	5.58	12.12	40.53	11.51
GDPg	2.41	**13.27**	9.68	15.42	12.24	32.68	16.7

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 8.3 – Impulse response function of Malaysia

Appendix D

African region

Angola

Table 8.1 – Unit root test of Angola

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.2135	0	-3.9521**	0	-0.2135	-3.8471**	-0.7303	0	-4.1306*	0
Reserves	-0.8496	0	-4.8513*	1	-0.9026	-3.8104*	-1.6180	1	-3.9134*	0
NEER	-4.3998	1	-2.4466	0	-3.4412	-2.6231	-2.2362	1	-2.5275	0
Fis-Bal	-4.7228	1	-5.7686*	1	-2.5846	-6.7048*	-4.9571	1	-5.6222*	1
GDPg	-2.7946	0	-5.7381*	0	-2.5155	-14.661*	-2.9291	0	-5.7773*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.2 – Lag interval tests of Angola (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-163.1343	NA	0.191851	15.37585	15.67341	15.44594
1	-42.63270	164.3204	0.000101	7.693882	9.776781	8.184550
2	24.58511	54.99639*	1.49e-05*	4.855899*	8.724140*	5.767140*

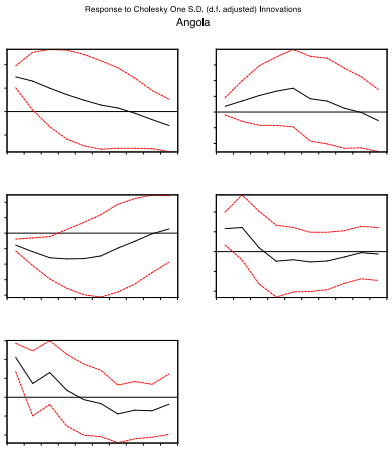
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.3 – Variance decomposition of Angola (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.65	**71**	20.58	2.08	0.88	5.1	0.8
Res	0.6	**39.46**	37.97	16.82	1.87	2.34	1.85
NEER	0.84	**76.91**	6.97	4.63	10.03	1	0.54
Fis	0.76	**33.67**	9.48	18.28	5.19	30.72	2.8
GDPg	6.68	**71.64**	15.36	6.64	0.93	3.63	1.8

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.1 – Impulse response function of Angola

Congo Rep.

Table 8.4 – Unit root test of Congo Rep.

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.4386	0	-6.6047*	0	0.2182	-6.6296*	-1.1624	0	-6.7669*	0
Reserves	-2.3770	0	-5.6394*	0	-2.3578	-7.3198*	-2.5213	0	-5.7965*	0
NEER	-2.5031	0	-5.5523*	0	-2.5031	-5.5660*	-2.0867	0	-5.5721*	0
Fis-Bal	-2.2648	0	-5.6425*	0	-2.2753	-5.7489*	-2.3012	0	-5.8420*	0
GDPg	-3.8559	0	-5.7353*	2	-3.8756	-17.646*	-4.0234	0	-5.6474*	2

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.5 – Lag interval tests of Angola (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-230.9541	NA	1.690625	17.55216	17.84012	17.63778
1	-156.3463	110.5301*	0.104112	14.69232	16.70806*	15.29170*
2	-113.5824	44.34774	0.098784*	14.19129*	17.93482	15.30444

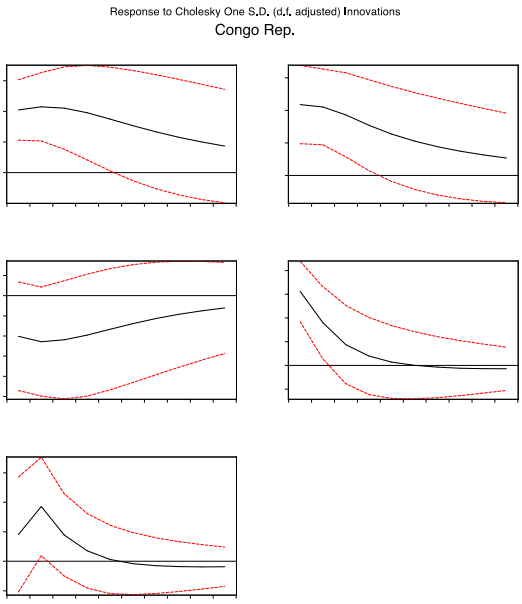
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.6 – Variance decomposition of Congo Rep. (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.73	**62.88**	26.02	4.93	6.23	0.49	0.04
Res	0.6	**59.21**	5.09	31.97	1.73	2.09	0.09
NEER	2.16	**19.75**	1.02	31.87	46.61	0.55	0.24
Fis	0.21	**43.71**	6.71	6.75	0.81	41.65	0.4
GDPg	11.23	**13.18**	11.37	2.98	1.13	12.41	58.93

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.2 – Impulse response function of Congo Rep.

Equatorial Guinea

Table 8.7 – Unit root test of Equ. Guinea

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	0.4283	0	-5.3477*	2	3.0849	-5.9670*	-0.5787	1	-4.7019*	0
Reserves	-0.8227	0	-4.4825*	0	-1.0429	-4.4825*	-1.0616	0	-4.6654*	0
NEER	-4.6654	0	-5.5523*	0	-2.5031	-5.5660*	-2.0867	0	-5.5721*	0
Fis-Bal	-2.3553	0	-5.4232*	0	-2.3553	-5.4323*	-2.2671	0	-5.4996*	0
GDPg	-4.5846	0	-5.3214*	2	-7.2229	-13.608*	-4.3051	0	-7.0713*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.8 – Lag interval tests of Equ. Guinea (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-191.8403	NA	2.608028	17.98548	18.28304	18.05558
1	-74.87900	159.4927*	0.001902	10.62536	12.70826	11.11603
2	-18.62951	46.02231	0.000758*	8.784501*	12.65274*	9.695743*

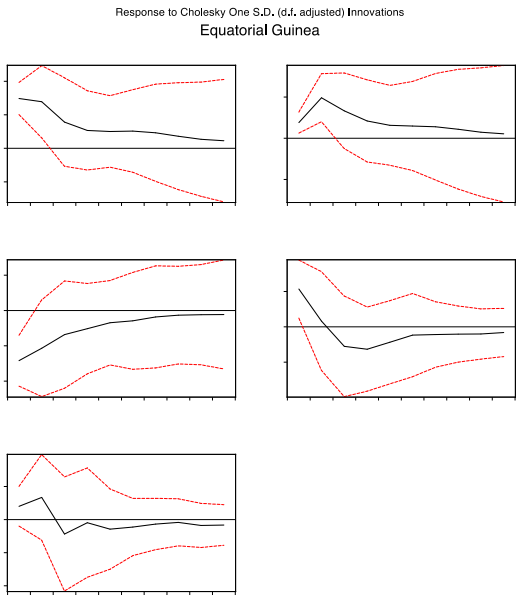
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.9 – Variance decomposition of Congo Rep. (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.41	**68.16**	5.62	25.56	0.96	2.28	0.33
Res	0.58	**36**	7.3	49.8	2.57	4.49	0.6
NEER	2.28	**41.93**	3.86	35.52	16.6	1.52	0.8
Fis	0.12	**25.8**	17.24	13.21	11.92	31.58	0.28
GDPg	10.68	**8.85**	47.84	15.47	3.55	19.57	4.72

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.3 – Impulse response function of Equ. Guinea

Gabon

Table 8.10 – Unit root test of Gabon

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.6491	0	-5.5970*	0	-1.6448	-5.6359*	-1.8543	0	-5.7596*	0
Reserves	-4.4246	0	-7.4140*	0	-4.4463	-10.442*	-4.1771	0	-7.4973*	0
NEER	-2.5031	0	-5.5523*	0	-2.5031	-5.5660*	-2.0867	0	-5.5721*	0
Fis-Bal	-3.1020	0	-6.2730*	1	-3.0659	-16.475*	-3.2203	0	-6.2439*	1
GDPg	-4.7179	0	-8.4582*	0	-4.7380	-10.788*	-4.5945	0	-7.6482*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.11 – Lag interval tests of Gabon (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-180.8753	NA	0.041401	13.84261	14.13058	13.92824
1	-103.5056	114.6218	0.002078	10.77819	12.79394	11.37758
2	-41.24370	64.56786*	0.000465*	8.832867*	12.57640*	9.946014*

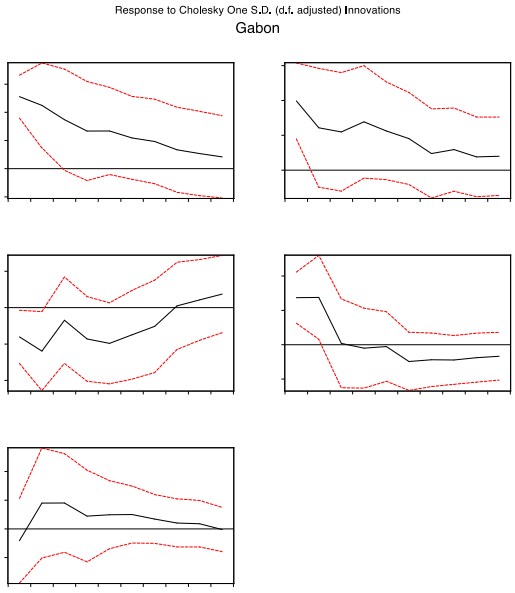
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.12 – Variance decomposition of Gabon (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.53	**84.51**	8.65	0.5	0.73	2.95	3.42
Res	0.44	**44.93**	16.79	30.64	1.16	4.28	3.05
NEER	1.76	**29.82**	15.75	31.26	13.61	2.38	8.25
Fis	0.13	**40.4**	8.84	17.77	6.02	21.85	5.69
GDPg	6.17	**10.07**	8.31	7.04	4.65	19.69	50.24

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.4 – Impulse response function of Gabon

Ghana

Table 8.13 – Unit root test of Ghana

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.9949	0	-6.6103*	0	-2.2993	-6.4000*	-2.0562	0	-4.9948*	0
Reserves	-2.2711	1	-4.4851*	0	-2.4400	-4.5039*	-2.3429	1	-4.2150*	0
NEER	-1.9524	0	-4.2459**	0	-1.9651	-4.2720**	-1.9418	1	-4.3389*	0
Fis-Bal	-1.7468	0	-5.0322*	0	-1.7170	-5.0250*	-2.1271	0	-2.1079	1
GDPg	-2.9031	0	-5.8941*	0	-2.8841	-9.1686*	-3.0982	0	-5.9919*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.14 – Lag interval tests of Ghana (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-194.2382	NA	0.065589	14.30273	14.58820	14.39000
1	-51.49578	214.1136*	3.42e-05*	6.678270	8.676576*	7.289172*
2	-11.90760	42.41591	3.93e-05	6.421971*	10.13311	7.556504

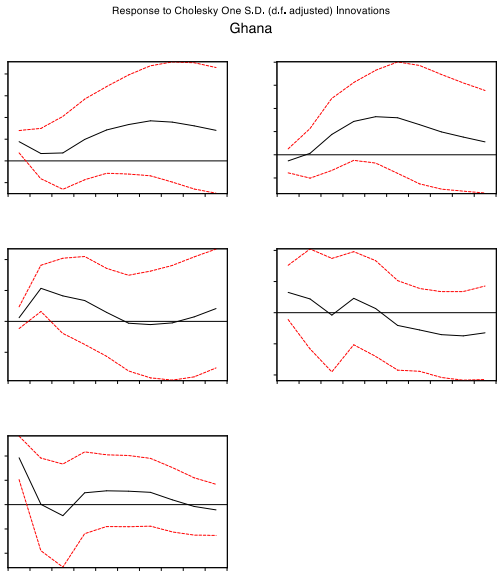
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.15 – Variance decomposition of Ghana (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.52	**37.52**	38.57	4.56	1.8	14.49	5.72
Res	0.38	**35.24**	18.54	31.29	1.63	10.93	4.03
NEER	0.7	**27.81**	6.87	12.34	27.38	17.91	10.52
Fis	0.26	**12.26**	8.3	6.55	0.63	62.52	10.83
GDPg	3.08	**36.74**	9.46	1.49	5.15	24.31	22.85

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.5 – Impulse response function of Ghana

Nigeria

Table 8.16 – Unit root test of Nigeria

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.0039	0	-4.8153*	1	-0.9224	-4.4070*	-1.3298	0	-4.8985*	1
Reserves	-1.9134	0	-4.1162**	1	-2.1781	-17.418*	-2.4405	1	-4.2474*	0
NEER	-2.3476	0	-5.2029*	0	-2.4010	-5.2598*	-2.1218	0	-5.1555*	0
Fis-Bal	-4.0602	0	-5.5132*	2	-4.0383	-19.289*	-4.1746	0	-5.7810*	2
GDPg	-2.3399	0	-5.9839*	2	-2.3080	-12.901*	-2.4725	0	-5.9981*	2

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 8.17 – Lag interval tests of Nigeria (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-192.9327	NA	0.059749	14.20948	14.49495	14.29675
1	-81.92668	166.5090*	0.000300*	8.851906*	10.85021*	9.462808*
2	-50.53199	33.63717	0.000621	9.180856	12.89200	10.31539

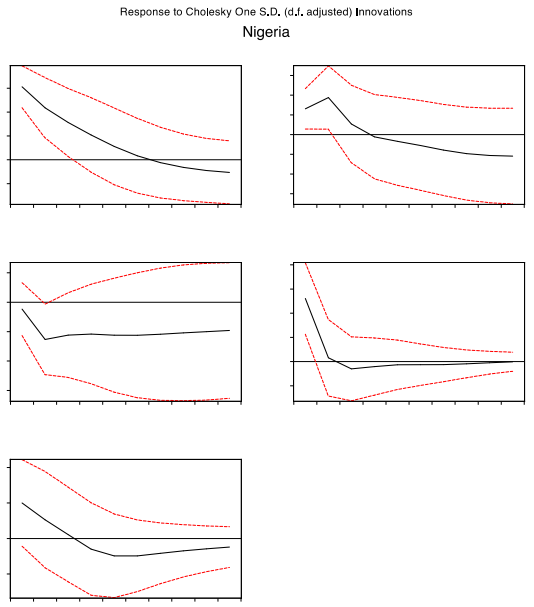
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 8.18 – Variance decomposition of Nigeria (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.59	**67.94**	15.91	1.39	12.1	0.47	3.05
Res	0.53	**17.39**	41.6	14.83	22.79	2.71	2.07
NEER	0.76	**21.43**	12.45	4.6	59.8	1.31	0.49
Fis	0.59	**29.5**	10.07	4.27	5.86	44.19	1.17
GDPg	4.75	**11.24**	4.39	2.96	8.95	18.94	53.52

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 9.6 – Impulse response function of Nigeria

Appendix E

Middle Eastern region

Iraq

Table 9.1 – Unit root test of Iraq

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.7790	0	-4.4004*	0	-0.8395	-4.5006*	-1.0700	0	-4.5787*	0
Reserves	-1.9667	1	-2.2146	0	-1.6449	-1.9856	-2.1324	1	-2.4068	0
Fis-Bal	-5.2786	1	-3.8664**	1	-1.7639	-1.9562	-5.5989	1	-4.0912*	1
GDPg	-4.9406	0	-6.1649*	1	-4.9615	-17.799*	-4.6994	0	-5.9676*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.2 – Lag interval tests of Iraq (Average of 10 periods)

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-44.61919	NA	3.44e-05	6.749225	7.032445	6.746208
1	58.00835	109.4694*	7.62e-09*	-2.134447*	-0.151906*	-2.155565*

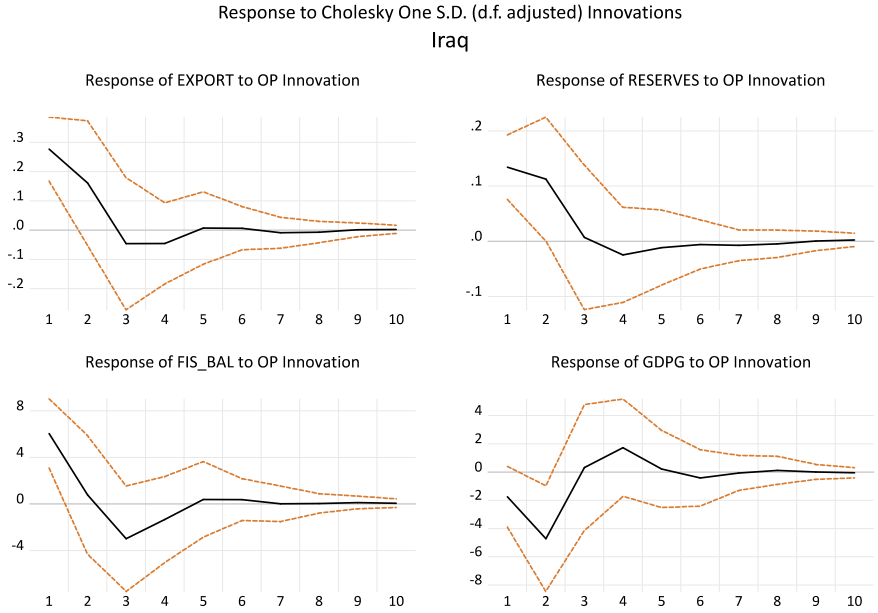
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.3 – Variance decomposition of Iraq (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*Fis*	*GDPg*
Exp	0.33	**84.43**	8.02	3.64	1.4	3.36
Res	0.35	**76.04**	3.87	8.61	10.89	1.86
Fis	0.2	**67.49**	3.32	9.35	17.99	2.04
GDPg	8.22	**48.39**	6.03	19.8	13.66	12.12

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.1 – Impulse response function of Iraq

Kuwait

Table 9.4 – Unit root test of Kuwait

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5778*	1	-1.1751	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-3.3847	0	-6.0587*	0	-3.4517	-7.0598*	-2.3442	0	-3.8853*	0
Reserves	-4.5237	1	-4.4597*	0	-2.1773	-4.5293*	-3.8815	1	-4.0523*	0
Fis-Bal	-8.6836	0	-8.1676*	0	-7.9639	-22.753*	-2.9062	0	-3.8332*	0
GDPg	-5.4463	0	-4.5557*	1	-5.4463	-11.952*	-3.6474	0	-4.9091*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.5 – Lag interval tests of Kuwait (Average of 10 periods)

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-179.6133	NA	1.011898	14.20102	14.44296	14.27069
1	-79.84171	153.4948*	0.003354*	8.449362	9.901012*	8.867385*
2	-54.06014	29.74796	0.004020	8.389242*	11.05060	9.155616

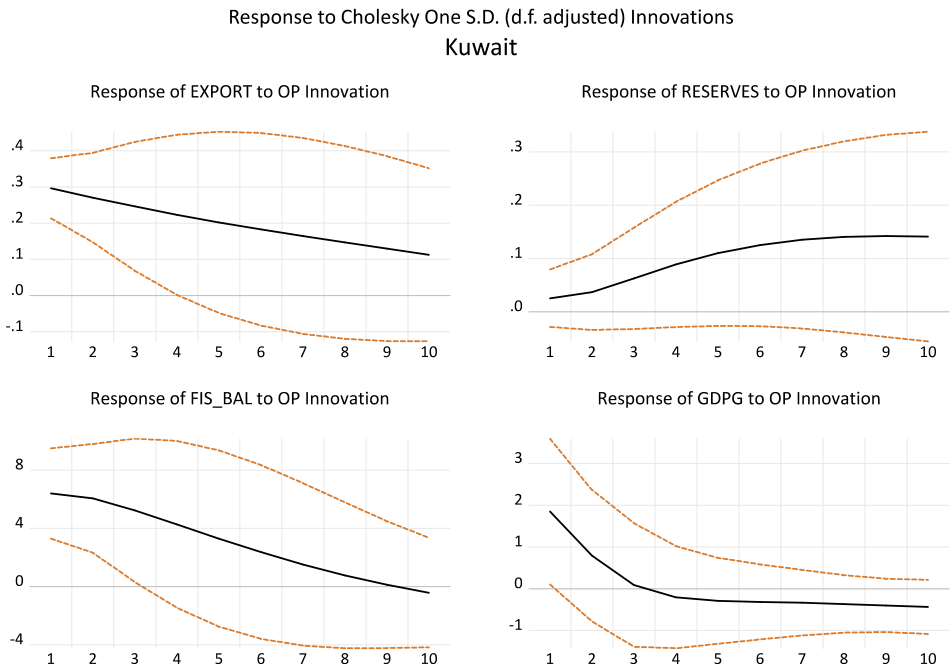
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.6 – Variance decomposition of Kuwait (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*Fis*	*GDPg*
Exp	0.74	**89.21**	1.63	1.82	7.68	0.13
Res	0.64	**43.36**	1.69	47.34	8	0.02
Fis	0.45	**58.65**	4.86	6.81	29.42	0.27
GDPg	15.18	**17.03**	45.53	2.97	5.69	28.78

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.2 – Impulse response function of Kuwait

Oman

Table 9.7 – Unit root test of Oman

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5778*	1	-1.1751	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.4334	0	-5.0286*	0	-1.2249	-4.8208*	-1.4334	0	-5.0286*	0
Reserves	-1.9058	0	-4.3707*	0	-2.1504	-4.3347*	-1.6312	0	-4.4937*	0
Fis-Bal	-1.7231	0	-5.1708*	1	-1.4354	-9.8901*	-1.8993	0	-5.3156*	0
GDPg	-3.0845	0	-6.7239	1	-3.1619	-6.9857*	-3.2370	0	-6.6927*	1

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.8 – Lag interval tests of Oman (Average of 10 periods)

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-169.5800	NA	0.179204	12.47000	12.70790	12.54273
1	-61.81874	169.3392	0.000502	6.558481	7.985843*	6.994840
2	-29.34522	39.43212*	0.000356*	6.024659*	8.641489	6.824650*

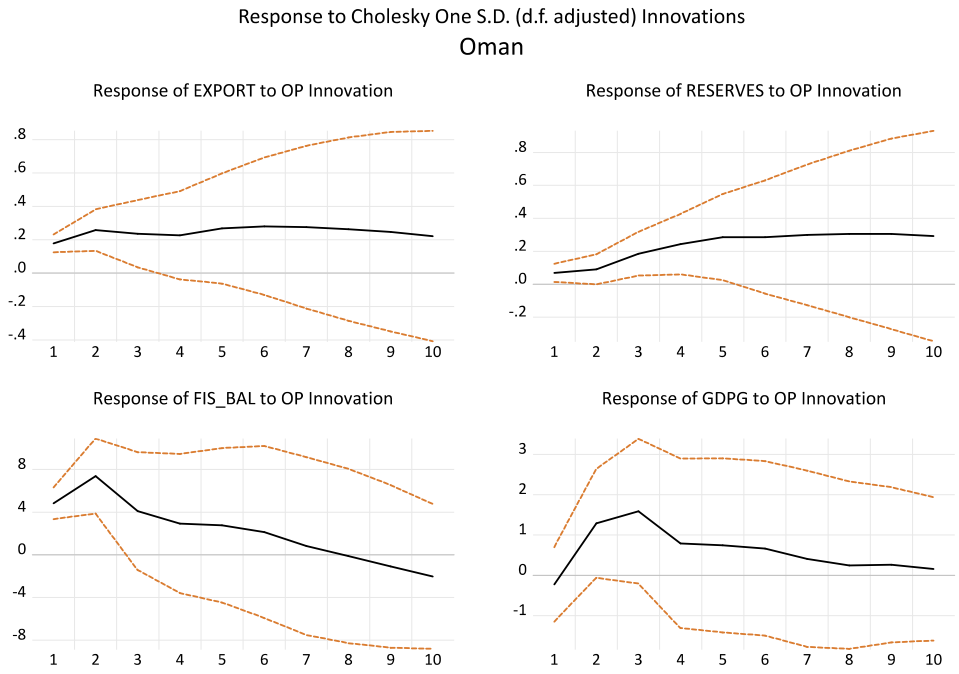
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.9 – Variance decomposition of Oman (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*Fis*	*GDPg*
Exp	1.22	**64.34**	10.09	5.08	1.34	20.5
Res	0.87	**56.17**	8.89	16.46	1.29	18.16
Fis	0.83	**57.71**	9.75	3.41	2.69	22.57
GDPg	15.5	**27.78**	25.35	4.76	3.61	38.5

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.3 – Impulse response function of Oman

Qatar

Table 9.10 – Unit root test of Qatar

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5778*	1	-1.1751	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.1586	0	-4.0180**	0	-0.3999	-3.9139**	-0.7179	0	-4.1906*	0
Reserves	-1.9875	0	-6.0018*	0	-2.0590	-6.0100*	-1.9959	0	-6.2164*	0
Fis-Bal	-2.4081	0	-6.7469*	0	-2.4081	-12.835*	-2.5605	0	-7.0024*	0
GDPg	-2.1337	1	-8.9602*	0	-3.0920	-9.6925*	-1.7379	1	-9.5166*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.11 – Lag interval tests of Qatar (Average of 10 periods)

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-134.8847	NA	3.872642	15.54275	15.79008	15.57685
1	-73.65698	81.63702*	0.078903	11.51744	13.00140	11.72206
2	-32.17384	32.26467	0.029969*	9.685982*	12.40656*	10.06111*

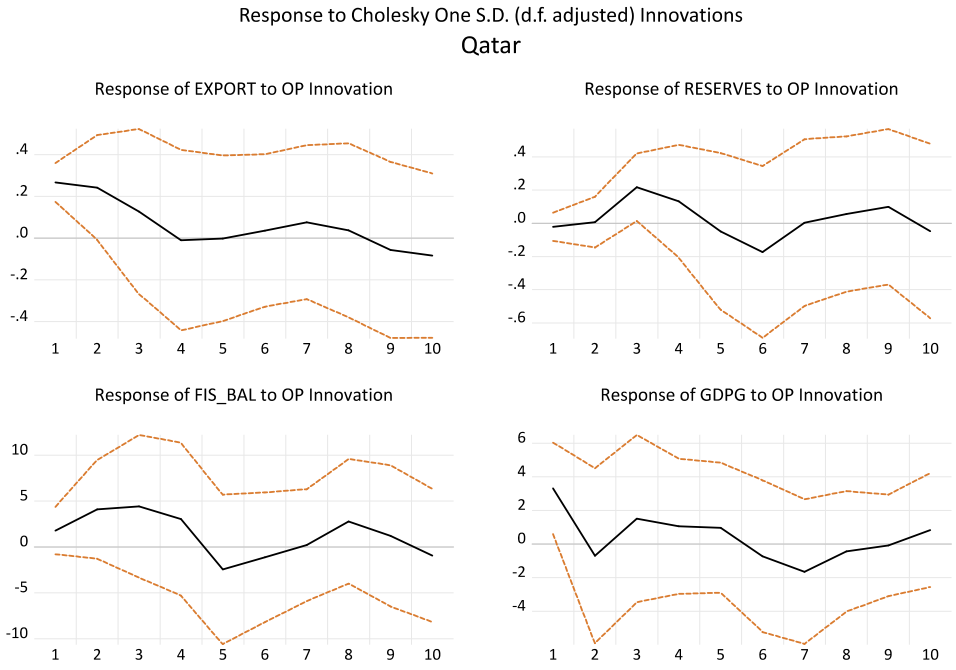
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.12 – Variance decomposition of Qatar (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*Fis*	*GDPg*
Exp	0.67	**52.64**	9.86	21.85	2.31	15.3
Res	0.56	**21.93**	14.09	38.93	11.02	15.35
Fis	0.61	**39.39**	11.36	8.5	21.18	15.35
GDPg	11.73	**27.82**	8.86	19.25	4.97	39.09

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.4 – Impulse response function of Qatar

Saudi Arabia

Table 9.13 – Unit root test of Saudi Arabia

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.1303	0	-4.5778*	0	-1.1751	-4.2105**	-1.4455	0	-4.5433*	0
Reserves	-1.2023	0	-4.7630*	0	-1.6693	-4.7632*	-1.3043	0	-4.2154*	0
Fis-Bal	-2.3273	0	-6.8596*	0	-2.3273	-7.3028*	-2.4290	0	-7.1146*	0
GDPg	-5.0829	0	-6.5739*	1	-5.0889	-10.372*	-4.0075	0	-6.5142*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.14 – Lag interval tests of Saudi Arabia (Average of 10 periods)

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-177.9080	NA	0.527042	13.54874	13.78871	13.62010
1	-85.99784	142.9714*	0.003852	8.592432	10.03225*	9.020566*
2	-58.04881	33.12477	0.003832*	8.373986*	11.01365	9.158898

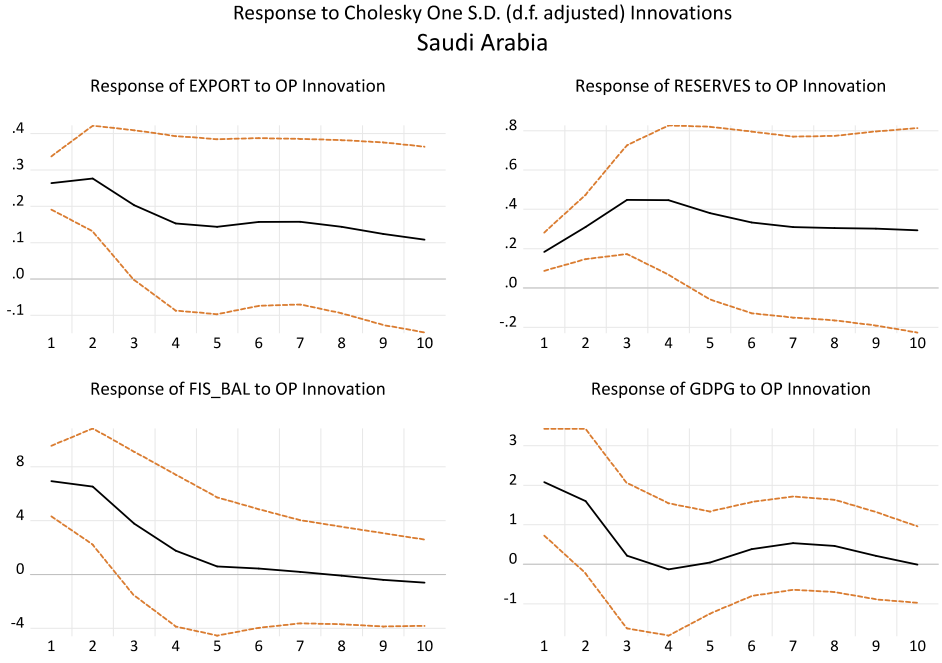
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.15 – Variance decomposition of Saudi Arabia (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*Fis*	*GDPg*
Exp	0.89	**63.14**	4.22	13.15	1.8	19.41
Res	0.69	**54.67**	7.26	18.34	0.98	19.79
Fis	1.22	**54.7**	5.22	6.81	15.37	13.59
GDPg	13.75	**31.12**	5.75	4.85	14.24	44.04

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.5 – Impulse response function of Saudi Arabia

U.A.E

Table 9.16 – Unit root test of U.A.E

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5778*	1	-1.1751	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.6428	0	-4.5368*	0	-0.7006	-4.4928*	-0.9827	0	-4.6607*	0
Reserves	-0.7183	0	-6.6536*	0	-0.6119	-6.4995*	-0.9729	0	-6.7716*	0
Fis-Bal	-2.5790	0	-5.5998*	0	-2.5606	-5.8284*	-2.7307	0	-5.6622*	0
GDPg	-4.2735	0	-5.8582*	1	-4.1811	-10.908*	-4.3297	0	-7.2089*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 9.17 – Lag interval tests of U.A.E (Average of 10 periods)

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-174.1900	NA	0.666746	13.78385	14.02579	13.85352
1	-95.15457	121.5930*	0.010891*	9.627275*	11.07892*	10.04530*
2	-77.58447	20.27320	0.024551	10.19881	12.86016	10.96518

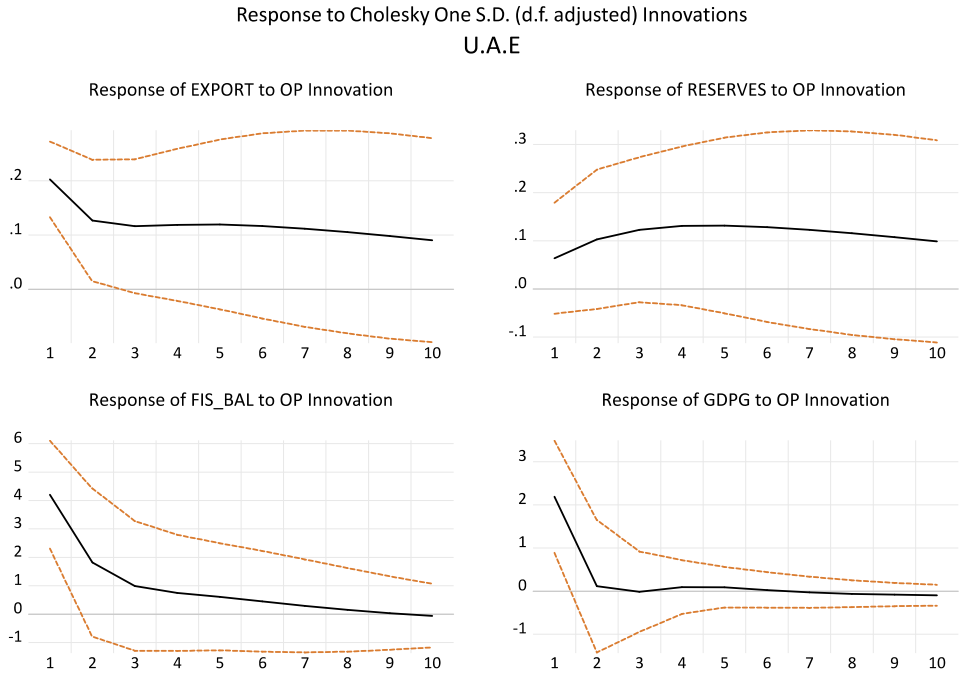
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 9.18 – Variance decomposition of U.A.E (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*Fis*	*GDPg*
Exp	0.68	**36.95**	8.79	48.41	3.84	4.86
Res	0.63	**18.62**	7.5	65.78	3.75	4.79
Fis	0.68	**32.59**	4.35	24.65	32.13	1.36
GDPg	8.24	**27.54**	9.67	13.7	17.99	31.11

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 10.6 – Impulse response function of U.A.E.

Appendix F

North African region

Algeria

Table 10.1 – Unit root test of Algeria

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.4859	0	-4.3886*	1	-0.3569	-4.2591*	-0.9501	0	-4.5428*	0
Reserves	0.5945	0	-5.5274*	0	1.2533	-5.6725*	-0.1826	0	-5.4336*	0
NEER	-3.0810	1	-3.3347***	0	-2.9774	-3.3347***	-1.9875	1	-3.4657**	0
Fis-Bal	-2.5394	0	-6.1121*	0	-2.5418	-7.6619*	-2.6350	0	-6.2868*	0
GDPg	-2.2482	0	-5.5289*	1	-2.0082	-8.4743*	-2.4914	0	-6.9784*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 10.2 – Lag interval tests of Algeria

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-161.6101	NA	0.006378	11.97215	12.25762	12.05942
1	-22.66023	208.4248*	4.36e-06	4.618588	6.616895*	5.229490*
2	19.41146	45.07681	4.20e-06*	4.184896*	7.896037	5.319429

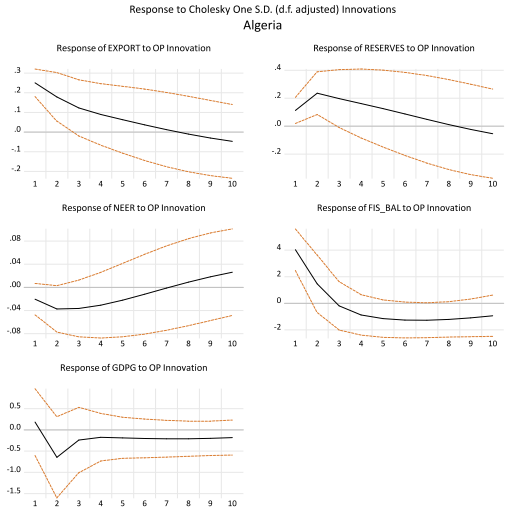
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 10.3 – Variance decomposition of Algeria (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.49	**47.5**	40.53	3.94	0.37	0.89	6.77
Res	0.53	**21.01**	51.17	17.28	1.84	1.41	7.3
NEER	0.8	**10.87**	29.5	2.56	41.44	7.75	7.89
Fis	0.19	**52.37**	19.81	1.04	2.03	23.15	1.6
GDPg	6.46	**8.07**	26.93	10.2	3.61	4.59	46.6

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 11.1 – Impulse response function of Algeria

Egypt

Table 10.4 – Unit root test of Egypt

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.0213	0	-4.7150*	0	-1.5221	-4.7693*	-1.1291	0	-4.5384*	0
Reserves	-2.7996	1	-3.9274**	0	-2.8688	-3.9468**	-2.7911	1	-3.3967**	0
NEER	-2.6137	1	-3.4604***	0	-1.8139	-3.0093	-2.6599	1	-3.5899**	0
Fis-Bal	-2.1934	0	-4.6966*	0	-2.1778	-4.7132*	-2.2348	0	-4.9774*	0
GDPg	-3.6784	2	-5.9090*	0	-3.2475	-5.8486*	-2.8483	0	-5.0909*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 10.5 – Lag interval tests of Egypt

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-80.98456	NA	0.000382	9.156269	9.454513	9.206744
1	20.84762	128.6301	4.64e-07	2.226566	4.314273	2.579889
2	121.8937	63.81858*	2.48e-09*	-4.620391*	-0.743221*	-3.964220*

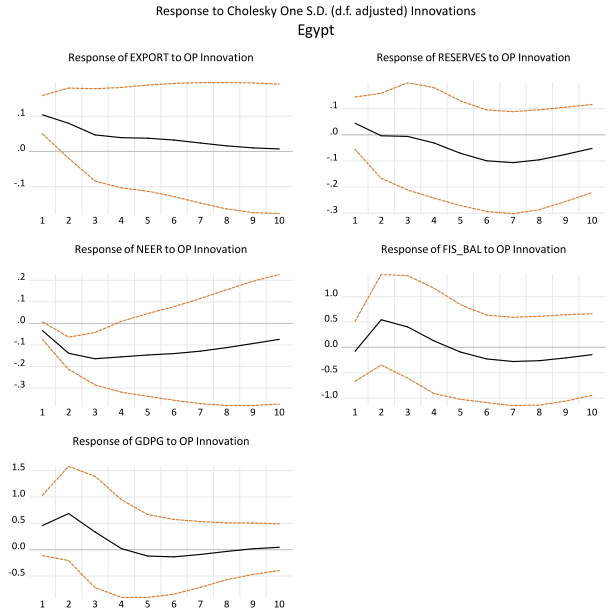
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 10.6 – Variance decomposition of Egypt (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.41	**28.5**	58.42	8.73	0.08	4.87	0.86
Res	0.28	**12.03**	10.84	62.96	1.69	2.05	14.35
NEER	0.43	**56.67**	5.31	17.17	19.42	0.28	1.31
Fis	0.37	**10.73**	16.84	32.95	3.52	28.25	9.72
GDPg	2.17	**19.92**	6.33	41.01	1.92	5.8	25.82

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 11.2 – Impulse response function of Egypt

Libya

Table 10.7 – Unit root test of Libya

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.6274	0	-4.8644*	0	-1.6085	-6.1916*	-1.9149	0	-5.0103*	0
Reserves	-1.1578	1	-2.9256*	0	-0.9833	-2.9256	-1.4405	1	-3.0344***	0
NEER	-1.0955	0	-4.4331*	0	-1.2527	-4.4331*	-1.2170	0	-4.5037*	0
Fis-Bal	-4.2276	0	-8.5544*	0	-4.2276	-12.001*	-4.3883	0	-8.1371*	0
GDPg	-3.6928	0	-7.2067*	0	-3.6769	-17.190*	-3.8339	0	-7.1799*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 10.8 – Lag interval tests of Libya

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-126.8120	NA	0.000755	9.837929	10.12589	9.923556
1	-29.97116	143.4680*	8.95e-06*	5.331197	7.346943*	5.930584*
2	11.29912	42.79881	9.49e-06	4.940806*	8.684335	6.053953

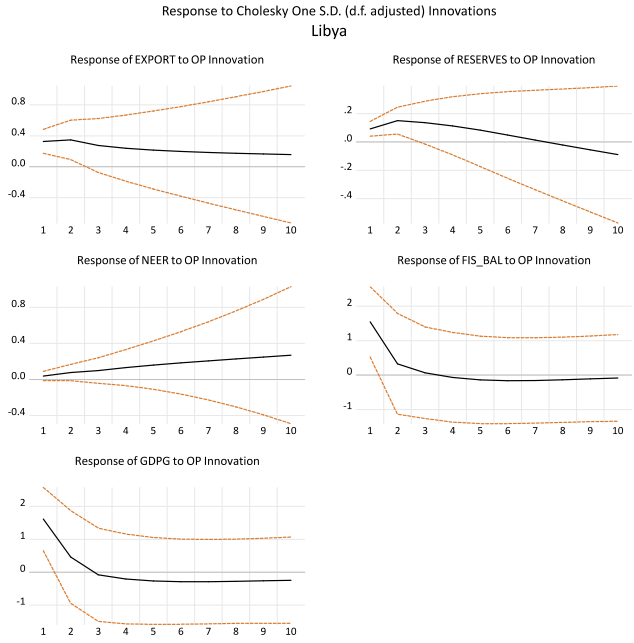
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 10.9 – Variance decomposition of Libya (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.54	**75.59**	26	0.33	0.15	0.74	0.02
Res	0.71	**44.51**	3.98	22.46	25.37	2.14	4.77
NEER	0.36	**37.22**	0.09	1.83	52.67	0.77	8.33
Fis	0.44	**28.03**	35.21	2.49	3.08	30.93	0.3
GDPg	3.01	**34.71**	30.15	1.2	5.25	16.48	12.21

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 11.3 – Impulse response function of Libya

Appendix G

Latin America region

Brazil

Table 11.1 – Unit root test of Brazil

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-0.7761	0	-4.4936*	0	-1.0276	-4.4625*	-1.0946	0	-4.6661*	0
Reserves	-1.8890	1	-4.4082*	0	-2.4202	-4.3714*	-2.1536	1	-3.2660**	0
NEER	-8.4542	0	-2.4009	0	-11.028	-2.5708	-2.6413	1	-2.1731	0
Fis-Bal	-1.4962	0	-3.7896**	1	-0.7523	-2.6688	-1.8987	0	-3.8842*	0
GDPg	-3.7326	0	-7.1364*	0	-3.6841	-11.208*	-3.8388	0	-7.2476*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 11.2 – Lag interval tests of Brazil

		Information criteria				
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-62.52138	NA	2.04e-05	6.229216	6.526773	6.299312
1	39.26228	138.7959*	5.93e-08	0.248883	2.331783*	0.739552
2	88.91851	40.62782	4.30e-08*	-0.992592*	2.875649	-0.081351*

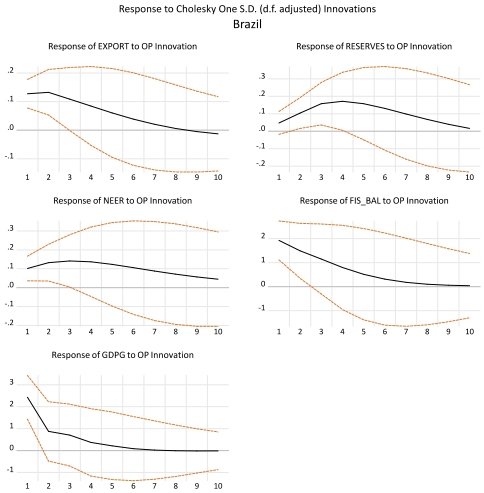
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 11.3 – Variance decomposition of Brazil (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.23	**16.11**	43.39	4.08	13.62	1.2	19.2
Res	0.33	**9.4**	57.62	10.03	8.49	1.35	15.67
NEER	0.38	**2.36**	61.46	5.3	32.43	0	0
Fis	0.95	**11.6**	66.81	1.83	0.51	19.25	0
GDPg	2.85	**6.55**	37.15	14.97	6.59	10.75	23.98

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 12.1 – Impulse response function of Brazil

Colombia

Table 11.4 – Unit root test of Colombia

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.1808	1	-3.4108***	0	-0.4293	-3.2917***	-1.6776	1	-3.5194**	0
Reserves	-1.5422	0	-4.1086**	0	-1.6701	-4.1086**	-2.1208	1	-4.0713*	0
NEER	-1.8388	1	-3.2322***	0	-1.8999	-3.2075	-1.7135	1	-3.3310**	0
Fis-Bal	-1.9560	0	-5.2672*	0	-1.9591	-5.2408*	-2.1355	0	-5.3878*	0
GDPg	-2.2862	0	-5.2016*	0	-2.2322	-5.0845*	-2.6822	0	-4.9870*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 11.5 – Lag interval tests of Colombia

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-125.4577	NA	0.000482	9.389837	9.675310	9.477109
1	45.02106	255.7182	3.46e-08	-0.215790	1.782517*	0.395112
2	96.47950	55.13404*	1.71e-08*	-1.319964*	2.391177	-0.185431*

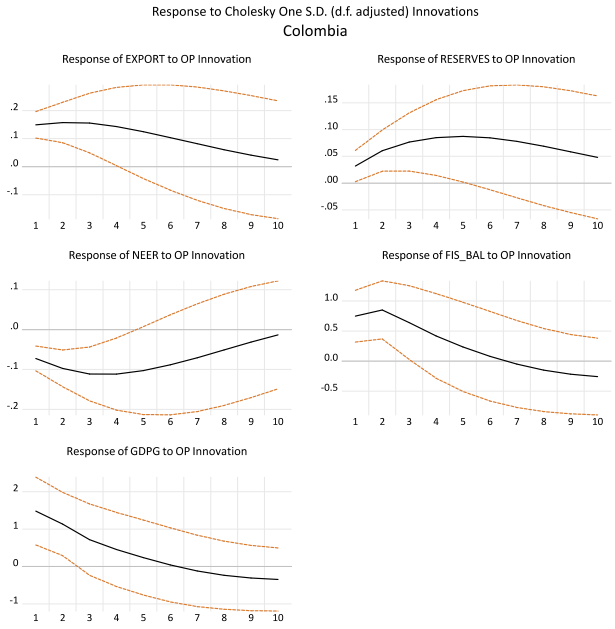
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 11.6 – Variance decomposition of Colombia (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.7	**59.63**	25.82	11.22	1.07	0.87	2.16
Res	0.44	**56.67**	10.36	29.55	2.82	0.42	0.37
NEER	0.25	**65.99**	9.75	9.26	6.34	7.31	1.8
Fis	0.29	**49.85**	3.07	10.3	0.64	33.6	2.69
GDPg	1.99	**41.75**	5.15	7.5	0.51	13.46	31.63

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 12.2 – Impulse response function of Colombia

Ecuador

Table 11.7 – Unit root test of Ecuador

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.1964	0	-4.6504*	0	-1.3782	-4.6504*	-1.4359	0	-4.8242*	0
Reserves	-2.9629	0	-5.8040*	0	-3.0556	-5.8710*	-3.1009	0	-5.8289*	0
Fis-Bal	-2.0286	0	-4.3958**	1	-1.8252	-4.0567**	-2.0618	0	-4.6573*	1
GDPg	-2.6760	0	-5.3560	1	-2.6917	-8.0595*	-2.9510	0	-6.3639*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 11.8 – Lag interval tests of Ecuador

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-131.0096	NA	0.094213	11.82692	12.07377	11.88900
1	-53.04374	115.2538*	0.001001*	7.221194	8.702274*	7.593682*
2	-24.99033	29.27312	0.001104	6.955681*	9.670993	7.638574

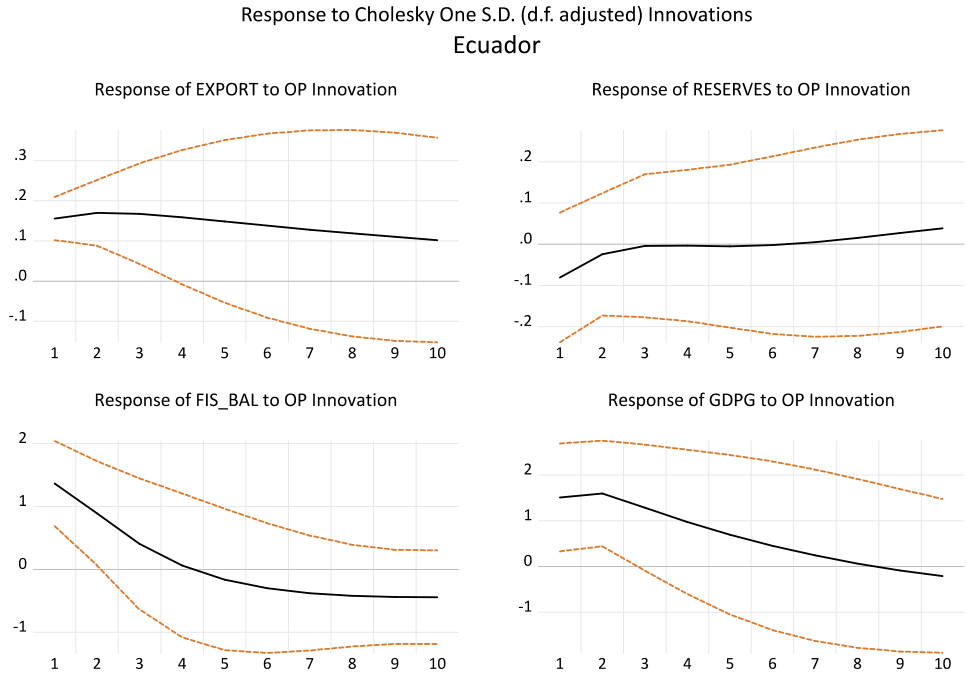
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 11.9 – Variance decomposition of Ecuador (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*Fis*	*GDPg*
Exp	1.24	**69.42**	7.93	4.9	8.84	2.02
Res	0.69	**15.11**	20.01	39.6	13.32	1.69
Fis	0.91	**47.55**	20.21	8.24	13.65	3.03
GDPg	4.13	**47.54**	11.58	6.15	17.14	9.12

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 12.3 – Impulse response function of Ecuador

Mexico

Table 11.10 – Unit root test of Mexico

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	-1.2566	0	-5.1903*	0	-0.1045	-9.9133*	-1.2520	0	-5.3191*	0
Reserves	-3.5152	0	-13.256*	2	-3.5408	-11.553*	-3.5992	0	-8.5921*	0
NEER	-2.1080	0	-4.4076*	0	-1.9921	-4.4098*	-1.8194	0	-4.4828*	0
Fis-Bal	-2.8989	0	-5.5322*	0	-2.8600	-5.5322*	-2.5390	0	-5.3497*	0
GDPg	-4.6650	0	-8.0684*	0	-4.3736	-12.653*	-4.7059	0	-8.1634*	0

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 11.11 – Lag interval tests of Mexico

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-130.1666	NA	0.000675	9.726184	10.01166	9.813456
1	-2.657533	191.2636	1.04e-06	3.189824	5.188131	3.800726
2	66.56608	74.16816*	1.45e-07*	0.816708*	4.527850*	1.951241*

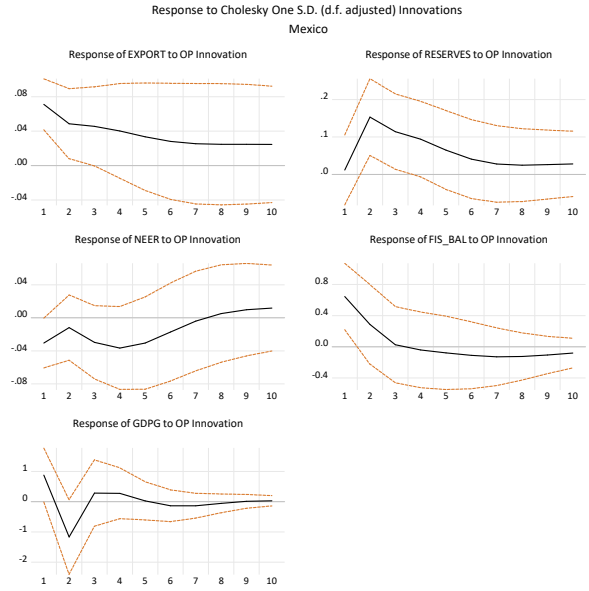
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 11.12 – Variance decomposition of Mexico (Average of 10 periods)

Variable	*SE*	***OP***	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.65	**35.3**	35.37	4.59	1.49	18.77	3.25
Res	0.2	**30.36**	11.61	44.92	5.11	6.69	2
NEER	0.4	**12.98**	32.17	10.99	21.48	20.84	2.72
Fis	0.17	**21.2**	0.1	2.92	0.99	67.62	2.27
GDPg	1.57	**15.55**	5.87	21.84	11.65	9.88	35.21

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 12.4 – Impulse response function of Mexico

Venezuela

Table 11.13 – Unit root test of Venezuela

Variable	The ADF Test				The PP Test		The DF–GLS Test			
	Level	k	First Diff	k	Level	First Diff	Level	k	First Diff	k
OP	-1.1082	0	-4.5882*	1	-1.1886	-4.0250*	-1.3932	0	-4.3847*	0
Exports	1.7925	2	-3.5498***	1	7.1386	-2.5517	-0.7268	1	-3.2558**	0
Reserves	-0.6089	0	-4.8721*	0	-0.6408	-4.8762*	-0.9693	0	-4.9891*	0
NEER	-2.0944	0	-5.1876*	0	-2.0944	-5.1875*	-1.8288	0	-5.3682*	0
Fis-Bal	-1.7826	2	-7.0004*	1	-2.9094	-8.7277*	-1.4670	2	-6.2837*	1
GDPg	-1.9014	0	-5.9008*	1	-1.7552	-6.8969*	-2.1082	0	-5.6741*	1

Notes: **, **, and *** refer to null hypothesis rejection at 1%, 5%, and 10% significance levels.*

Source: Compiled by the author from the preliminary analysis

Table 11.14 – Lag interval tests of Venezuela

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-195.9400	NA	0.418196	16.15520	16.44773	16.23634
1	-78.99973	168.3940	0.000707	9.679979	11.72769	10.24793
2	-10.26850	65.98199*	9.24e-05*	7.061480*	10.86437*	8.116241*

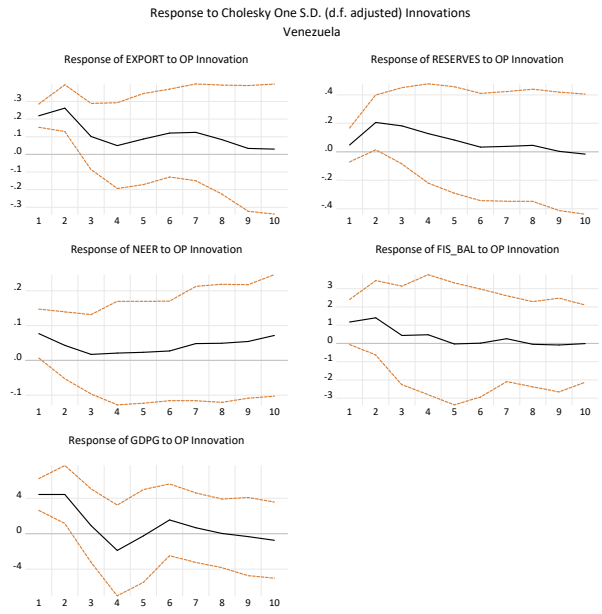
Notes: ** Indicates lag order selected by the criterion.*

Source: Compiled by the author from the preliminary analysis

Table 11.15 – Variance decomposition of Venezuela (Average of 10 periods)

Variable	*SE*	*OP*	*Exp*	*Res*	*NEER*	*Fis*	*GDPg*
Exp	0.4	**75.13**	5.26	6.7	10.08	0.98	0.41
Res	0.38	**19.04**	1.43	65.69	7.3	6.45	1.63
NEER	0.5	**27.97**	6.72	10.82	52.69	1.2	0.79
Fis	0.45	**42.36**	1.4	16.81	8.67	32.32	1.09
GDPg	5.67	**19.92**	19.53	12.68	8.77	11.98	27.12

Source: Compiled by the author from the variance decomposition results



Source: Compiled by the author

Figure 12.5 – Impulse response function of Venezuela