Oil Volatility and Government Spending Behaviour in Oil-Exporting Countries

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ABSTRACT

This thesis principally seeks to provide an empirical examination of the contribution of the dynamic relationship between oil volatility, including revenue, price and rent in relation to government spending behaviour in OPEC and non-OPEC oil exporting countries. A research gap has been identified in three areas, firstly, there is a paucity of comparative literature between OPEC and non-OPEC countries. Secondly, there exists a limited number of studies of oil volatility and the effect on government expenditure. Thirdly, there is little research on the impact of volatility in relation to the quality of political institutions and the influence of extant democratic processes. The thesis, therefore, seeks to contribute to closing these gaps. In particular, the study, firstly, investigates the impact of oil volatility on aggregated government spending. Secondly, it investigates the effect of oil volatility on disaggregated government spending, namely, on health, education and military expenditure. Thirdly, it analyses the effects in periods of high and low oil volatility regimes. Fourthly, it studies the impact of the quality of political institutions on the relationship. Put it differently, the thesis evaluates whether the response to oil volatility differs between democracies and non-democratic states. To achieve this aim, a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions over the period 1983-2015 are applied.

We find that oil price volatility does not exert any significant effect on aggregated government spending of OPEC countries whereas oil revenue volatility precipitates a decline in economic growth, an increase in inflation and, the maintenance of government expenditure leading to a greater share of the percentage of GDP. Oil rent volatility exercises both a direct and indirect impact on government expenditure via the exchange rate and inflation channels. In contrast, non-OPEC countries are susceptible to oil price uncertainty but are unaffected by higher oil revenue volatility. Oil rent volatility affects government expenditure directly and has an indirect effect through GDP channel.

When the focus turns to specific areas of government expenditure, the influence of oil volatility on health expenditure appears to have no effect on that of education in both OPEC and non-OPEC countries. However, it leads to a rise in health and a reduction in military expenditure in OPEC countries and an increase in the share of military spending in non-OPEC states. However, an increase in oil revenue volatility leads to a rise in military expenditure in OPEC countries with no effect in non-OPEC countries. On the other hand, oil rent volatility increases health and military expenditures. Overall, oil volatility leads to higher military expenditure.

Turning to the quality of political institutions, it is observed that in democratic countries an increase in oil volatility leads to an increase in government expenditure. In contrast, in non-democratic countries, governments' response to oil volatility fluctuating between the positive and

negative depends on the quality of political institutions; the more some attributes of democracy are seen, the greater the expenditure. This difference in response between them can be attributed to a variation in institutional quality. When the individual components of government expenditure are analysed, we find that in democratic countries, an increase in oil volatility is accompanied by an increase in education and health expenditure, whilst military expenditure remains unchanged. In contrast, in non-democratic countries, oil volatility leads to a reduction in the share of education and health expenditure and an increase in military expenditure. When the degree of democratic attributes is controlled the rate of reduction of health and education expenditure slows, but rising military expenditure is unaffected. Therefore, the behaviour of governments in relation to different component of expenditure are dependent on the quality of the institutions they control; the more the tendency towards a degree of democracy, the less the effect of volatility on health and education whereas the less democracy the greater the emphasis on military spending.

There are a number of policy implications that arise. The destructive nature of oil revenue volatility in oil exporting countries indicates a need for some defensive strategies. These could be in the form of the creation of a sovereign wealth fund invested in exogenous non-oil business vehicles providing an alternative form of revenue. Regulatory controls could be adapted to include the use of alternative financial instruments such as the futures and bond markets and the encouragement of FDI inflows would provide a platform for technology transfer encouraging upstream and downstream oil related industries. Structural changes could be introduced to allow an expansion into oil price derivatives, the expansion of oil market value chains and deregulation which would serve to eliminate monopolies. An improvement in strategic risk planning together greater government transparency could lead to institutional quality improvement and the development of health and educational facilities which would both improve national welfare and increase absorptive capacity to provide a platform for industrial expansion.

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DEDICATION

With all my love and admiration

I dedicate this thesis to my true inspirers and role models,

To my husband, Ebrahim

And my parents, Mahdi and Mahboubeh

DECLARATION

This thesis is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy at the Bournemouth University, United Kingdom. I declare that this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that this thesis has not been previously or concurrently submitted, either in whole or in part, for any other qualification at Bournemouth University or other institutions.

Azadeh Pazouki

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Chapter 1- Introduction

1.1 Introduction

Oil is a strategic commodity and its importance to all aspects of human endeavour, both influences and is influenced by macro, socio economic and political factors. Its dominant role in the global economy makes the issue of demand, supply and price major determinants in decisions taken by governments of all political and ideological persuasions and, this is particularly true of the oil exporting nations. Clearly supply and demand influence price which therefore becomes the key factor in the decision-making process. To that end oil price forecasting is a critical tool of both governments, oil companies and major users. Essentially the price of oil is set in the oil futures market and is largely determined by supply and demand and market sentiment. However, other factors intervene in the process including the influence of cartels, refining capacity and geo-economics and political risks. These have the capacity to destabilise the market and create volatility which can increase both risk and uncertainty.

Oil economic effects vary according to the behaviour of price in the global oil market (Bouchaour and Al-Zeaud 2012) and any uncertainty arising from oil price volatility may impact economic growth and the macro economy (Rafiq et al. 2009; Omojolaibi 2013; El-Anshasy et al. 2015), reduce international trade flows raising risks faced by both exporters and importers, and could even reverse globalization (Chen and Hsu 2012). The impact of oil price volatility on the economy is not a simple task as it constitutes a real challenge for policy makers; economic and financial authorities (Bouchaour and Al-Zeaud 2012). The effect of economic, industrial or geopolitical events on the price of oil has the potential to create significant volatility in the oil price market and is one of the key disruptors of performance in oil exporting countries given the relative significance of the oil sector in production, exports, and any uncertainty in the world oil markets (Mehrara 2008). Therefore, it is necessary to understand the different effects of oil price volatility on the economy overall. Due to over-dependency on oil revenues, the oil-exporting economies have demonstrated a degree of vulnerability to oil price volatility in the global market. For example, the oil price reduced from $106.85 per barrel in January 2014 to $74.03 in November with a consequent adverse economic effect and Nigeria being forced to devalue the Naira (Lin et al. 2015). Volatility in the oil market can manifest itself in a number of ways, namely, price, revenue and oil rent, the latter being defined as the difference between revenue and production costs. This volatility influences the governments' monetary and fiscal policies in both oil-importing and exporting economies. A government's spending behaviour can be significantly changed based on any fluctuation in oil prices and associated increase (decrease) in oil price volatility.

The aim of this doctoral research study is to empirically examine the dynamic relationship between oil uncertainty and government spending behaviour in oil-exporting countries. The consequences of the varying strand of oil volatility will impact directly government expenditure with increases or decreases potentially dependent on whether it is high or low. Oil markets have seen almost unprecedented volatility since January 1974 with no clear long-term pattern with literature identifying a number of influences including production, demand and stockpiling shocks resulting from geopolitical events and changes in the business cycle (Baumeister and Kilian 2015). There are a number of studies that examine optimal fiscal policies in oil exporting countries but there are not many that evaluate the effects of oil price volatility on the former, as most concentrate on oil price or oil price shocks (Anshasy and Bradley 2012). For optimal fiscal policy (Chalk 1998; Valdes and Engel 2000; Olters and Leigh 2006; Pieschacon 2008; van der Ploeg and Venables 2009), for oil price shock transmission to the domestic economy (Bollino 2007; Pieschacon 2009; Areski and Van der Ploeg 2010) and for oil price volatility (Ferderer 1996; Anshasy and Bradley 2012). In this thesis the writer attempts to expand the debate in this area by examining how and to what extent oil uncertainty (approximated by oil price volatility, oil rent volatility and oil revenue volatility) on aggregated and disaggregated government spending behaviour in oil-exporting economies. In particular, the oil price volatility, oil revenue volatility and oil rent volatility effect on current government expenditure on the economies of oil exporting countries will be assessed and a comparison made between the OPEC cartel and non-OPEC exporting countries.

We should note here that there is a tendency for the terms risk and uncertainty to be used interchangeably in academic literature but there are important conceptual differences. Knight (1921) distinguishes between risk and uncertainty by interpreting risk as the ability to assign probabilities to outcomes, whereas, in the case of uncertainty, one could not. This interpretation is disputed by Langlois and Cosgel (1993) who claim that the difference is between a predicable market and one disrupted by moral hazard and adverse selection. This research is based on time series panel data and draws conclusions on the basis of conditional variable mined from literature. Therefore, no distinction is made in this research between risk and uncertainty and the word risk is made only where the context is immediately apparent.

1.2 Background to the research

Hamilton (2009a,b) identifies two oil price shocks, that is; demand side oil price shocks, which stem from changes in aggregate demand, and supply-side, which stem from changes in oil production. Furthermore, Hamilton (2009b) argued that demand-side shocks created by the industrialization of countries such as China could have a significant impact. He also voiced the opinion that lack of immediate response of oil-supply to a large-scale increase in oil-demand could result in a demand-side shock. According to Kilian (2009) the real price of crude oil could be decomposed into three components: (1) shocks to the current physical availability of crude oil ("oil supply shocks"), (2) shocks to the current demand for crude oil driven by fluctuations in the global business cycle ("aggregate demand shocks"); and (3) shocks driven by shifts in the precautionary demand for oil ("precautionary demand shocks"). Precautionary demand arises from the uncertainty about shortfalls of expected supply relative to expected demand. Fattouh (2012) demonstrated that there is a polarised debate about the drivers of oil prices which includes fundamentals and expectations relating to shocks, financialization of oil markets (massive expansion in the financial layers of oil: more funds, higher trading volumes, more instruments, increasing sophistication of financial instruments), speculation and market manipulation. Meanwhile, Matar et al. (2013) have introduced some factors which influence the volatility of the crude oil price. These factors range from the elasticity of supply and demand, inventory levels and storage, volume of transactions, open interest and maturity effect, the effective exchange rate of the dollar and even economic-geopolitical shocks and instabilities. Also, in the debate on oil markets financialization, Basak and Pavlova (2016) claimed that the financialization of commodities, affect commodity prices and all futures prices, volatilities, and correlations that increase with financialization. Also, Ma et al. (2019) findings show that the financial predictor has the greatest forecasting power for crude oil volatility, which provides strong evidence that financialization has been the key determinant of crude oil price behavior since the 2008 global financial crisis.

Recent hikes and price fluctuations in global oil markets since 1999 have attracted attention and invoked concerns about their devastating effects on a variety of economic activities (Chen and Hsu 2012). Hence, a number of theoretical and empirical studies have examined the positive or negative impacts of oil price shocks on the macroeconomic variables e.g. (Kilian 2006; Du et al. 2010; Farzanegan 2011; Bouchaour and Al-Zeaud 2012; Asgari 2013; Dizaji 2014; Boheman and Maxén 2015; Herwartz and Plödt 2016); but most economics researchers focused on the oil-importing countries (Bouchaour and Al-Zeaud 2012; Emami and Adibpour 2012) or developed/industrialised oil-exporting countries (Olomola 2006). Therefore, as noted by Rasmussen and Roitman (2011), the manner in which oil prices affect developing economies such as the majority of OPEC countries have received surprisingly little attention, given the large body of literature on their effects in advanced economies.

According to Rafiq and Salim (2014, p.418) existing "research on oil prices and economic activities primarily investigates two different aspects of the relationship between oil price and economic activities: the impact of oil price shocks and the impact of oil price volatility". It should be noted that the manner in which they incorporate oil price into their models are different in these two approaches. The first approach (oil price shocks) takes oil prices at their level, and the second approach (oil price volatility) employs different volatility measures to capture the oil price uncertainty. Oil price shocks and the impact on different key macroeconomic variables such as economic growth (Hamilton 1983; Lardic and Mignon 2006; Prasad et al. 2007; Elder and Serletis 2010) and unemployment (Uri 1996; Davis and Haltiwanger 2001; Altay et al. 2013) have been explored by both practitioners and scholars in the economics area over last four decades. This impressive body of literature on oil price shocks highlights the importance of negative or positive oil price shocks for economies and the different impact from both supply and demand (Rafiq and Salim 2014). Relatively few studies investigate the relationship between oil price volatility, oil revenue volatility, oil rent volatility and different key macroeconomic variables.

In relation to oil revenue volatility Mehara (2008) finds that negative as opposed to positive volatility has a greater economic effect with the latter having a limited impact in promoting economic growth, and this is taken as evidence of the Dutch disease. The effect of foreign currency movements on imports creating greater competition for indigenous markets as a result of price rises a natural resource. Price volatility is widely covered in literature but amongst the most influential are Hooker (1996) and Hamilton (1996) who both demonstrated that a relationship existed between GDP growth and a "net oil price increase" calculated as the year over year price increase. They found that increases were a correction of previous decline with these having a lower macroeconomic effect after 1973. In relation to oil rent volatility, Mehrara and Oskoui (2007) found that in the major oil exporting countries variability has resulted in a detrimental spillover into real economic activities, albeit that in countries like Kuwait this has been mitigated by the existence of stabilisation and saving funds.

Oil revenue in most of the oil-exporting countries such as Nigeria, Saudi Arabia, Iran, and Venezuela, is the core source of financing physical and social infrastructures (Ayadi 2005; Farzanegan 2011; Emami and Adibpour 2012). This has caused oil price change to be the main source of macroeconomic fluctuations in these economies, which in turn, have important effects on both economic activities and macroeconomic policy (Chemingui and Hajeeh 2011; Emami and Adibpour 2012). Therefore, in order to mitigate the effect of boom and bust the implementation of strict countercyclical fiscal rules and building the appropriate political incentives that ensures respecting them and retiring the debt during windfall episodes allied to diversifying the economy, establishing saving funds and delinking government expenditure from oil revenues (El-Anshasy 2012; Emami and Adibpour 2012).

El-Anshasy (2012) states that "the main policy implication for oil-exporting countries is that it is imperative to use strict fiscal rules, backed by the appropriate political incentives, to insulate public spending from oil cycles" (p.120). In other words, government spending dynamics usually acts as a key transmission mechanism of oil price volatility and oil price shocks to the macroeconomic (Tazhibayeva et al. 2008; Pieschacon 2009; El-Anshasy 2012). Fiscal dependence on oil renders makes fiscal management highly challenging for oil-exporting economies (El-Anshasy 2012). Therefore, different fiscal characteristics can be considered as potentials of retarding growth in these economies. The findings of a number of studies such as Robinson and Torvik (2005) and (El-Anshasy 2012) support the argument that large increases in the public capital during oil booms can be unproductive for oil-exporting economies and typically result in very low return.

In this doctoral research study, different effects of oil volatility on real economic activities, fiscal policies, and government spending behaviour in OPEC and non-OPEC oil-exporting economies will be examined, utilising an empirical model that simultaneously estimates the parameters of government spending behaviour in an internally consistent fashion.

The motivation for the emphasis on volatility emanates from the literature review where the discussion initially reviewed research relating to the economic effect of oil price changes. This subject already contains a rich vein of literature in relation to oil pricing and the effect on macroeconomic performance (Burbidge and Harrison 1984; Gisser and Goodwin 1986; Mork 1989, 1994; Mork et al. 1994; Lee et al. 1995; Hamilton 1996; Lee and Ni 2002; Hamilton 2003; Cunado and De Gracia 2005; Cologni and Manera 2008; Hamilton 2009; Tang et al. 2010); the influence on output and fiscal policy (Rasche and Tatom 1977, 1981; Darby 1982; Hamilton 1983, 1996; Burbidge and Harrison 1984; Santini 1985; Gisser and Goodwin 1986; Mork 1989 and Lee et al. 1995) and the theoretical links between oil price shocks and the economy (Elwood 2001; Filis and Chatziantoniou 2014). The literature on oil price volatility is more muted with oil exporting countries receiving little attention. The existing literature is contradictory with El-Anshasy et al. (2015), Selmi et al. (2012), finding a negative effect of volatility on oil exporting countries. In contrast Oriakhi and Osaze (2013) find the Nigerian economy reacting positively to oil price volatility. However, there is a paucity of literature on oil price volatility in oil exporting countries and this is particularly true in relation to OPEC. A research gap has been identified with little work having been conducted in this area particularly in relation to the effect on government expenditure.

In addressing this research gap, it is important to identify the importance of oil volatility in relation to national economies. There are economic consequences to volatility since the cause may create prices to rise or fall with the forecasting of the direction and size of change being problematic. This leads to uncertainty, and in such an environment, to difficulty in determining, from a governmental perspective, macroeconomic and fiscal policies which in turn has an impact on investment decisions resulting in an effect on economic growth, employment and ultimately national welfare. The interest in and importance of volatility lies in its uncertainty since in highly volatile environments it is difficult to predict in which direction price will travel. In consequence it is difficult for policy makers to determine an effective strategy to mitigate a volatile environment. This is an important consideration for both oil exporters and importers since it impacts both fiscal and monetary policy and its implications for both economic and national welfare predicates the study of volatility separately from the oil pricing function. For nation states, oil price volatility can disrupt government budgets, create a necessity for radical economic reforms, or present geopolitical conundrums that can be influenced depending on the causes and consequences of the uncertainty created. In periods of prolonged price volatility where prices range from sub $50 to in excess of $100 the effect on macroeconomic indicators (e.g., investment, supply, demand, employment); the search for alternatives to oil; the influence on government fiscal and monetary policy can be significant. For example, the reaction of the largest economies (United States and China) and significant oil producers (OPEC) will have global consequences including investment in oil, relationships with and between oil producers, the use of strategic reserves by the US; all may affect how geopolitics evolves in the ensuing turmoil. Governments and Central Banks in both importing and exporting countries are increasingly taking cognisance of oil price volatility and their decisions will have far reaching consequences for the global economy. However, oil volatility is under researched and this thesis makes an important contribution to knowledge in relation to its effect on fiscal policy and government expenditure in oil exporting countries.

1.3 Research aim and objective

The overall aim of this research project is to evaluate the relationship between oil volatility and government spending behaviour in oil-exporting countries. To achieve this aim, the main objectives of this study are propounded as follows:

i. To examine the direct and indirect effect of the oil volatility to the aggregated government spending in oil-exporting countries.
ii. To investigate the direct and indirect effect of the oil volatility to the disaggregated government spending in oil-exporting countries.
iii. To analyse the effect of the oil volatility in periods of high and low regimes on the aggregated and disaggregated government expenditure in oil exporting countries
iv. To study the dynamic impact among oil volatility, the quality of political institutions, and government spending in oil-exporting countries.
v. To evaluate whether different approximations of oil volatility provide different insights in the said relationship.

1.4 Structure of the thesis

The presentation of this piece of research follows the structure of the doctoral thesis suggested by Bournemouth University. This section outlines the overall structure of this thesis and provides an organisational pattern of the procedure of this research project. The thesis comprises seven chapters. These chapters have been organised as below:

Chapter 1: *Introduction.* The introductory chapter provides a short introduction to the topic of this doctoral research and explores theoretical and empirical research background of the oil volatility and government spending behaviour. It defines the aims, rationale, and purpose for undertaking this research study, which is conducted to answer three critical questions on oil volatility and oil-exporting countries spending behaviours. It outlines the scope of significance and the structure of this doctoral thesis.

Chapter 2: *Literature Review.* This chapter focuses on oil price chronology, the theoretical points of the research topic and discusses existing theories and academic theoretical and empirical studies related to the research topic. In particular, it explores the findings of other scholars whose work in this field, and their results can be compared with the finding of this research study. This chapter additionally discusses the literature related to the oil price changes, oil price volatility and macroeconomic impacts on both oil-exporting and oil-importing economies.

Chapter 3: *Methodology.* Chapter 3 discusses the research philosophy, research design, research methodology and methods that used in the research and explains how these elements contribute to systematic research in order to establish facts and reach conclusions, hence, a well-defined methodology is essential if reliable results are to be obtained. This chapter also provides an extended discussion of the methodology used in this thesis, mainly a panel Vector Auto-Regressive (PVAR) model.

Chapter 4: *Data and Method Description.* Chapter 4 discusses the datasets that are used to address the aims and questions of this research and includes data definition and sources. Then, the model framework and the oil volatility are measured. Moreover, macroeconomic data, the choice of macroeconomic variables and preliminary data analysis are presented.

Chapter 5: *Oil Volatility and Aggregated Government Expenditure.* **C**hapter 5 examines the effect of the oil volatility on aggregated government spending in selected oil-exporting OPEC and non-OPEC countries. To achieve this aim, we apply a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions over the period 1983-2015.

Chapter 6: *Oil Volatility and Disaggregated Government Spending Behaviour.* **C**hapter 5 investigates the direct and indirect effect of the oil volatility on the disaggregated government spending. This chapter analyses the dynamic effects of oil price volatility, oil rent volatility and oil revenue volatility on different categories of the OPEC and non-OPEC governments spending from 1983 to 2015, using panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions.

Chapter 7: *The dynamic impact among oil volatility, the quality of political institutions, and government spending.* This study has used the PVAR model to empirically estimate the effect of the oil volatility, the quality of political institutions, and government spending in oil-exporting countries over the period 1983 to 2015.

Chapter 8: *Conclusion and Recommendations*. This final chapter presents a summary of the overall findings of the research based on the data analysis conducted in previous chapters. It highlights the main results of this research study, outlines its major contributions and limitations, describes directions for further research in this field, and makes recommendations to reduce the negative impacts of oil volatility on macroeconomics and effective spending governmental behaviours in oil-exporting economies.

Chapter 2- Literature Review

2.1 Introduction

The price of oil and its attendant consequences on economic output and development is one of the most important issues confronting a growing number of world economies (Ayadi 2005; Cunado and De Gracia 2005; Jiménez-Rodríguez and Sánchez 2005; Cologni and Manera 2008; Kilian 2008; Park and Ratti 2008; Gonzalez and Nabiyev 2009; Ghosh 2011; Emami and Adibpour 2012). Crude Oil is the most traded good in the world, and its price volatility is a key source of disturbance for the economies of oil exporting countries given the relative significance of the oil sector in production and exports and uncertainty in the world oil markets (Mehrara 2008; Elder and Serletis 2010; Bencivenga et al. 2012; Ji and Guo 2015). According to the Energy Information Administration (EIA) Global economic performance keeps highly correlated with oil prices (Gonzalez and Nabiyev 2009). In other word, oil prices appear to have made a metrical contribution to countries' macroeconomics (Burbidge and Harrison 1984; Gisser and Goodwin 1986; Mork 1989, 1994; Mork et al. 1994; Lee et al. 1995; Hamilton 1996; Lee and Ni 2002; Hamilton 2003; Cunado and De Gracia 2005; Cologni and Manera 2008; Hamilton 2009; Tang et al. 2010).

The early evidence on this subject is that oil price increases shifts income from oil-importing to oil-exporting countries through a transfer in the terms of trade (Mehrara 2008; Akpan 2009; Cologni and Manera 2009; Jbir and Zouari-Ghorbel 2009; Greene and Liu 2015), which leads to a decrease in global demand in the oil-importing nations (Ayadi 2005; Jbir and Zouari-Ghorbel 2009).

The magnitude of the direct effect of positive oil price shocks given a price increase depends on the share of oil revenue in national income, the degree of dependence on exported oil and the ability of end-users. In this regard, higher oil prices lower disposable income and this reduces consumption (IEA 2006; Akpan 2009). However, when the oil price rises are remaining stable then private investments decline. Likewise, when oil is employed less in production, capital, labor productivity and output decreases. Several studies, such as those of (Rasche and Tatom 1977, 1981), (Darby 1982), (Hamilton 1983, 1996), Burbidge and Harrison (1984), Santini (1985), Gisser and Goodwin (1986), Mork (1989) and Lee et al. (1995) show that oil prices increase decreases output and increases inflation and also affects trade and exchange rates, therefore, tax revenues decrease and budget deficits increase (Berument et al. 2010).

There is a presumption amongst policy makers that there is a linear relationship between oil price and economic activity and policies designed under this paradigm can suffer from any subsequent oil price uncertainty (Jo, 2014). Theoretical work has suggested oil price shocks not only have a negative effect on macroeconomic activity, but they also influence volatility (Ferderer 1996). There is evidence in some studies that there exists an asymmetric relationship between oil price changes and output growth which cannot be explained by price alone. Federer (1996) posits that this is because the economy, as a whole, is in fact responding to oil price volatility. Thus, as indicated by Rafiq and Salim (2014, p.418) existing “research on oil prices and economic activities primarily investigates two different aspects of the relationship between oil price and economic activities: the impact of oil price shocks and the impact of oil price volatility”. These distinctions between oil price shocks and oil price volatility are important in that the response to the former is likely to be immediate with fiscal policy and business decisions orientated towards countering the immediate impact whereas volatility could be a more long term effect creating difficulties in designing effective long term macroeconomic, fiscal and monetary policies with consequent impact on infrastructure and business investment. The potential presence of an asymmetric response may well be derived from the effect of different aspects volatility on key areas of the macroeconomy and this is particularly true of the main focus of this thesis, namely oil exporting countries. Oil price shocks and the impact on different key macroeconomic variables such as economic growth (Hamilton 1983; Lardic and Mignon 2006; Prasad et al. 2007; Elder and Serletis 2010) and unemployment (Uri 1996; Davis and Haltiwanger 2001; Altay et al. 2013) have been explored by both practitioners and scholars in the economics area over last four decades. However, there are relatively few studies investigating the relationship between oil price volatility and the different key macroeconomic variables. For instance, Oil price volatility will, assuming no remedial action, will result in an effect on real exchange rate, whereas, oil revenue (a government receipt) volatility affects both fiscal policy and to a degree determines savings and investment decisions with significant impact on national welfare (Oriakhi and Osaze 2013; Mehrara and Oskoui 2007).

Oil price volatility can significantly change government fiscal policies and the spending behaviours and rules and particularly in oil-exporting countries (Berument et al. 2010; Sturm et al. 2009; Emami and Adibpour 2012). Oil price volatility and a change in government spending have, consequently, different effects on the economy, and different fiscal policies are required to minimise the negative effects in oil-exporting economies (Nakibulla and Islam 2007; El-Anshasy 2012).

This chapter will explore the research work that was carried out by economics researchers relevant to understanding the effects of oil price volatility, oil price changes, and oil price shocks on key macroeconomic variables a with focus on government spending behaviour in industrial and developing economies. First, this review of the literature describes the trend of global oil prices over last four decades. Second, it highlights the theoretical foundation of the study. Third, it explores the literature and the empirical evidence on the effects of oil prices and the economic impact of oil price shocks in the context of both oil-importing and oil-exporting economies and the consequences of oil price changes and oil price volatility on key macroeconomic parameters. Fourth, it evaluates the empirical evidence on the effects of oil price volatility uncertainty in an economic context. Finally, this review explains the gap in the literature. The main thrust of this review of literature is to identify both the empirical views and the limited qualitative existing theoretical views relevant to this thesis.

2.2 Oil price chronology

The global oil market has experienced different negative or positive shocks over the past four decades. Different key factors such as political, economic, technological, and natural can negatively or positively affect supply and demand in the global oil market, which can be reflected in oil price fluctuation. These factors can lead to a state of instability for both oil-importing and oil-exporting nations as an oil shock in the global oil market can potentially cripple the economies of the world; especially the fragile renter economies that are related to the oil industry (Bouchaour and Al-Zeaud 2012). For these reasons, the crude oil price has been effectively monitored by all countries as a strategic commodity for their economic growth.

Oil price cycles have been highly unpredictable during the last decades (El-Anshasy 2012). Figure 2.1 shows the price of crude oil over last century. The oil price environment has had an impact on both demand and supply prospects in the short- and medium-term, and some lasting effects can be expected in the long-term. The oil price can also be central to global economic developments, as economic factors have weighed heavily on the oil market OPEC (2015a).

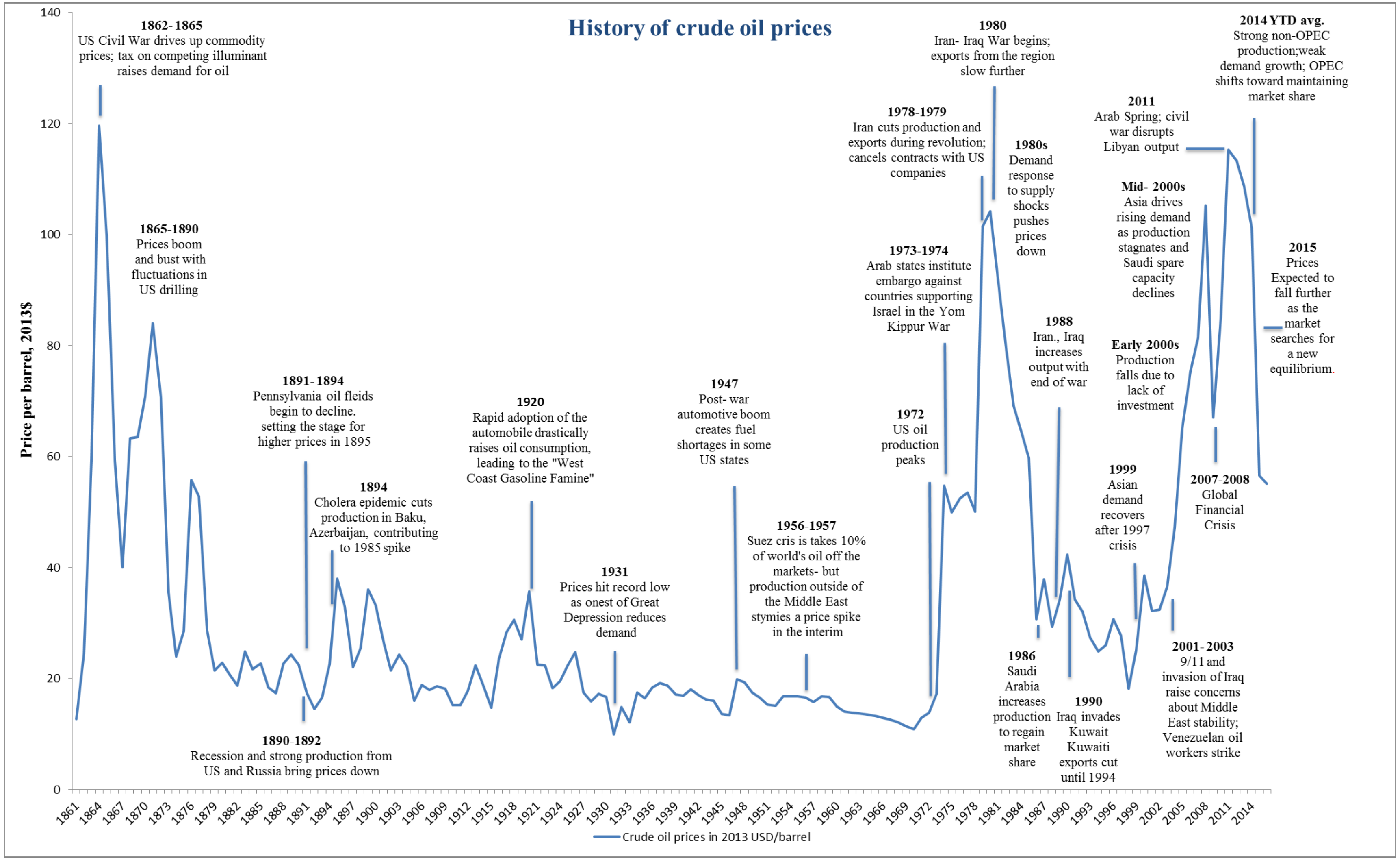


Figure 2.1. Historical crude oil prices – Last 150 years

2.3 Theoretical background

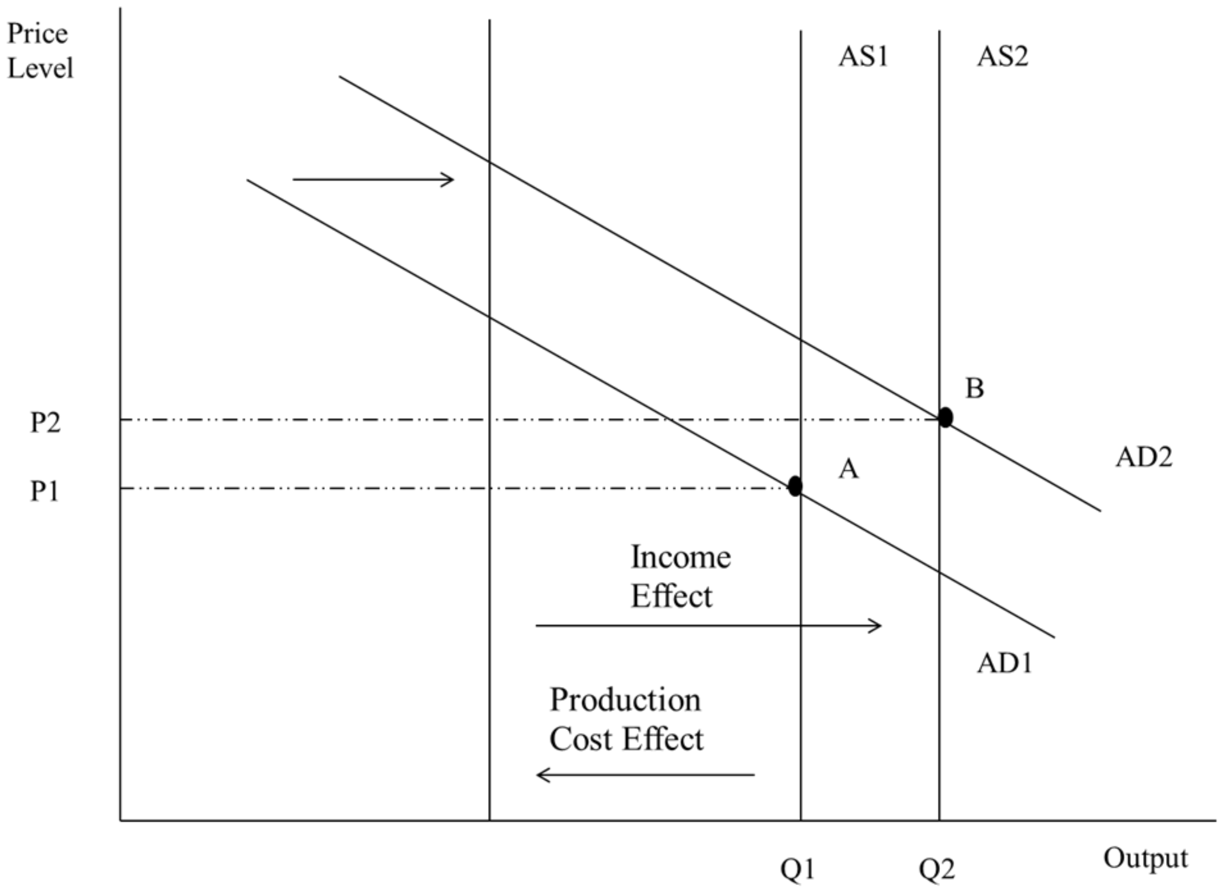
2.3.1 Impact of oil Prices on economic growth

The rise and fall of oil prices have a significant effect on economic growth. These effects are anticipated to be diverse in oil importing and exporting countries. As a matter of fact, oil price increase is considered excellent news for oil exporting countries and bad news in oil importing countries, with the converse being true when oil prices fall. Therefore, oil price rises will affect positively real gross domestic product (GDP). Furthermore, economists are trying to examine the association between oil price volatility and economic growth. Thus, they identify that oil price increases are observed as a positive signal for oil exporting countries with a positive reception to exchange rates, which will have a significant and positive impact on economic growth. Substantially, oil prices and exchange rates have a positive effect on economic growth in these countries (Shafi and Hua 2014).

2.3.2 Theoretical links between oil price shocks and the economy

An interpretation of oil-price shocks in the aggregate demand / aggregate supply (AD/AS) framework is presented by Elwood (2001) with further analysis being provided by Filis and Chatziantoniou (2014) in relation to net oil-exporting and importing countries. Accordingly, Figure 2.2 is obtained from Filis and Chatziantoniou (2014) that embodies the effects of an oil price shock on a net oil- exporting country. The effects of an increase in the price of oil is anticipated to be positive, as initially, the income of this country is likely to increase, shifting the AS_1 curve towards the right (AS_2)—this is displayed as the income effect. It is reasonable to anticipate that the increase in oil prices will increase production costs (effect) in the oil exporting country. However, the magnitude of the income effect can reverse the negative impact of oil on production costs, therefore leading to an overall increase in aggregate supply (Q2). Moreover, these changes along with the shift in the modified AD curve provides a new long-run equilibrium (point B) with a higher level of welfare, as the value of export demand for oil increases. As a result, both consumption and investment are anticipated to rise in magnitude and this, in turn, will cause a rise in employment. Finally, it effects demand-side inflation with price levels increasing from P1 to P2.

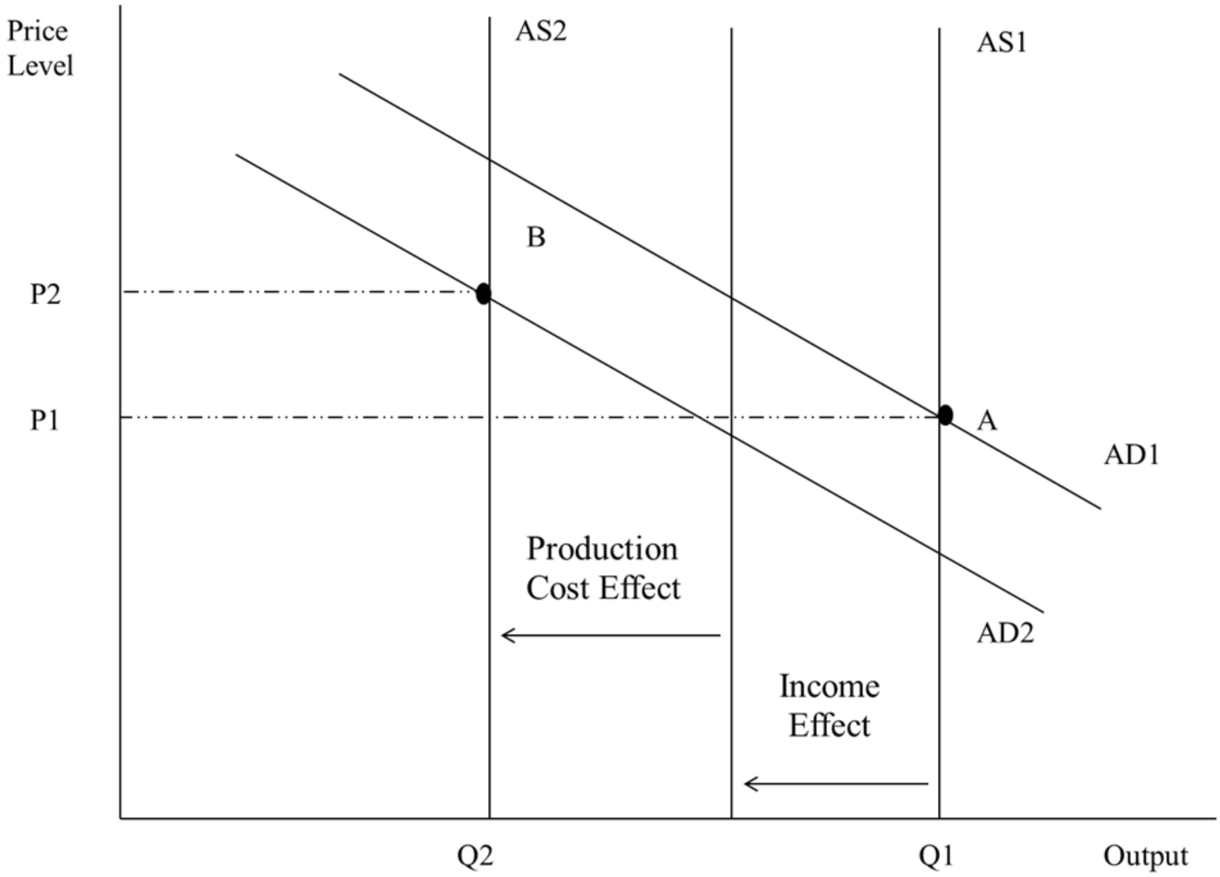
Figure 2.2. The effect of an increase in the price of oil on an oil-exporting economy



Source 2.1: Filis and Chatziantoniou (2014)

Figure 2.3 is adopted from Filis and Chatziantoniou (2014) that depicts the effects of an oil price shock on a net oil-importing country by modifying the AD/AS framework. In fact, both the income and production cost effects move the modified AS curve in the same direction. The oil price rise will have a negative influence on the economy's welfare, causing a decline in the quantity supplied (income effect). Additionally, increased production costs will be passed on to consumers. The results exhibit that there are a low level of aggregate demand (AD1 curve will shift to the left to AD2) and the price level increases (the price ratio move from P1 to P2).

Figure 2.3. The effect of an increase in the price of oil on an oil-importing economy



Source 2.2: Filis and Chatziantoniou (2014)

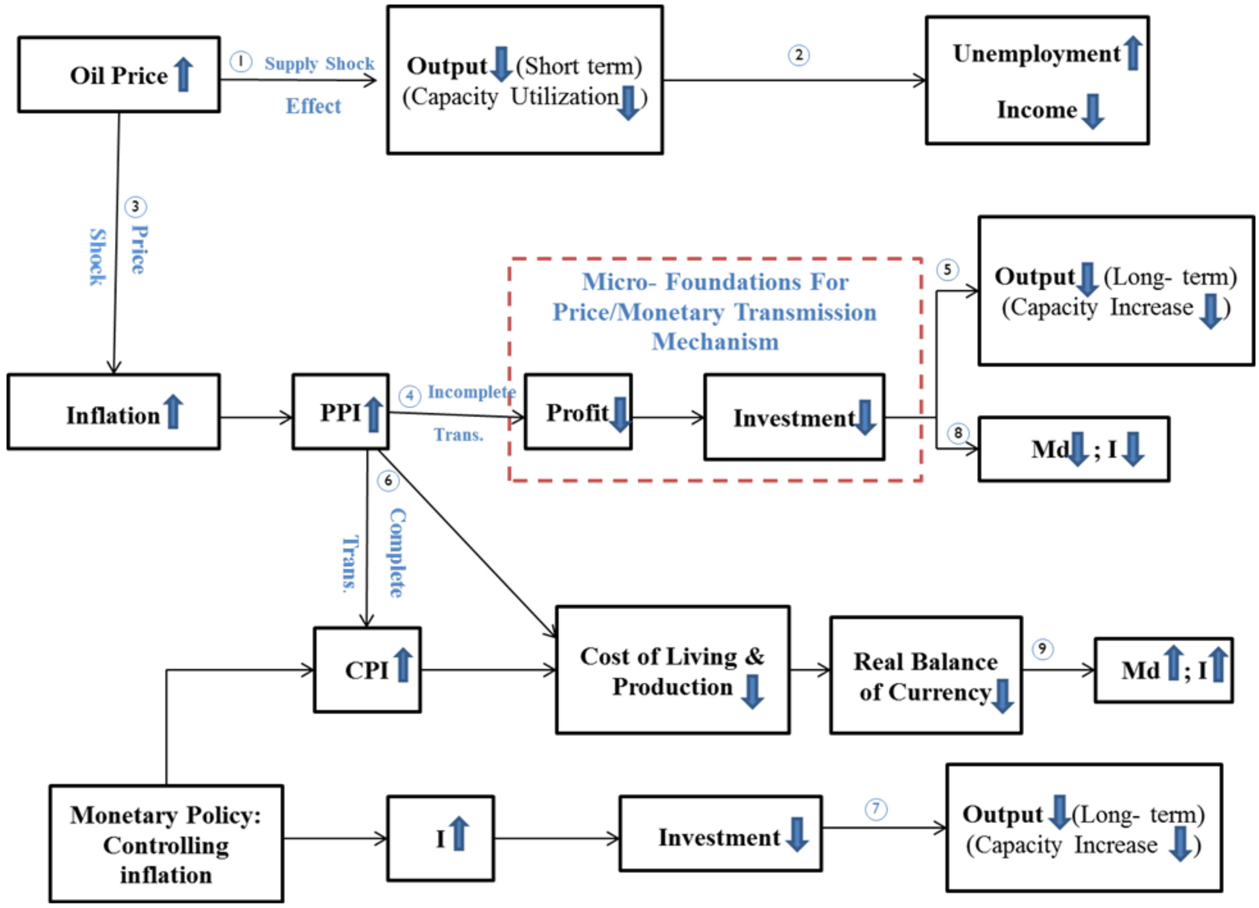
In overall terms, an increase in oil prices is affecting the oil producing countries from two perspectives: firstly, there is a positive effect with income and wealth rising in oil producing countries, because importing countries pay more and if the exporting countries deploy that income domestically, then investment will increase together with employment. Currency also appreciates which increase money supply. Secondly there is a negative effect, as initially, increases in oil prices will decrease demand for oil in oil importing countries and worsen the balance of trade position in the oil exporting country (Amano and Van Norden 1998b; Jiménez-Rodríguez and Sánchez 2005; Kilian 2008; Aliyu 2009; Bjørnland 2009; Hamilton 2009; Al-Ezzee 2011; Brahim Fezzani 2011).

2.3.3 The transmission mechanisms (Channels)

From a theoretical view, oil price fluctuations affect the performance of macroeconomic variables through the following six transmission channels (Davis and

Haltiwanger 2001; Brown and Yücel 2002; Lardic and Mignon 2008; Doğrul and Soytas 2010; Tang et al. 2010; Bouchaour and Al-Zeaud 2012; Ahmad 2013); Figure 2.4 illustrates this point:

Figure 2.4. Transmission channels of oil- price shocks



Source 2.3: Chuku et al. (2010)

2.3.3.1 Supply-side shock effect: focusing on the direct impact on output due to the change in marginal producing costs caused by oil-price shock

First, there is a classical supply side effect according to which an increase in oil price leads to a decrease in potential output level since the price increases signals the reduced availability of basic input to production (see among others, Brown and Yucel 1999; Beaudreau 2005). Therefore, there is an increase in the cost of production and growth and production rate decline. Slowing productivity growth decreases real wage growth and increases unemployment rate (Brown and Yucel 1999; 2002).

According to supply side effects, oil price shocks increases the marginal cost of production in many industries therefore leads to the increase in production costs. Indeed, high production costs make it unfeasible for firms to continue production at full or existing levels, resulting in reduced output decreasing economic growth and increasing unemployment. In such situations, it is difficult to reallocate specialized labor and capital immediately from one industrial sector to another and labor has to wait for better job opportunities and for economic conditions to normalize therefore aggregate employment declines. After oil shocks, with investment defining potential output capacity in the long run, the higher input prices decrease investment with consequent output reductions (Brown and Yucel 2002).

2.3.3.2 Wealth transfer effect: emphasizing on the different marginal consumption rate of petrodollar and that of ordinary trade surplus

The second transmission channel is the wealth transfer effect with an oil price increase deteriorating terms of trade for oil-importing countries (Dohner 1981). Hence, it highlights the shift in purchasing power from oil importing nations to oil exporting nations Fried et al. (1975), Dohner (1981). The shift in purchasing power parity reduces consumer demand for oil importing nations and increase it in oil exporting nations. Subsequently, the demand for world production in oil importing nations is reduced and increases in oil exporting countries. Additionally, the total demand of world goods decreases because the magnitude of the reduction in demand is greater than the increase. Then, the reduction in purchasing power of oil importing countries causes an increased supply of savings, resulting in lowering of interest rates.

The investment in oil exporting countries increases because savings flow from oil importing countries to higher interest rate countries (oil exporting countries); due to excess supply of funds interest rates fall. Consequently, aggregate demand of the oil exporting countries increases. Diminishing world interest rates should stimulate investment, which balances the reduction in consumption and leaves aggregate demand unchanged in the oil importing countries. As Brown and Yücel (2002) maintained, if prices are downwardly sticky, the decrease in demand for goods produced in oil importing countries will further reduce economic growth. If the price level cannot fall, consumption spending will fall more than any increase in investment leading to the fall of aggregate demand and a further slowing of economic growth.

2.3.3.3 Inflation effect: analysing relationship between domestic inflation and oil prices

Inflation effect is the third transmission channel, which establishes a relationship between domestic inflation and oil price shocks. The latter can be accompanied by indirect effects, called second round effects, giving rise to price-wages loops. Whenever inflation is caused by oil price-increase cost shocks, a contractionary monetary policy can decrease long-term output and create higher unemployment by increased interest rates and decreased investment.

Cost shocks in upper-stream industry can be transmitted from producers across sectors to end-users. A well-developed industrial chain can transmit inflationary shocks from upper-stream to down-stream, leaving the producers' profit rate affected. That can raise the overall cost for consumers and producers, thus reducing consumers' real balance effect, defined as a change in aggregate expenditure on real production made by government, business and consumers. This transmission ends up with the reduction of consumption and the real output as well. This is the story witnessed in most developed countries Tang et al. (2010).

2.3.3.4 Real balance effect: investigating the change in money demand and monetary policy

The fourth transmission effect is the real balance effect is proposed by Pierce et al. (1974), Mork (1994). Along with the real balance effect, increase in oil prices leads to increase in money demand. When monetary authorities fail to increase money supply to meet growing money demand, interest rate will raise reducing the growth rate Brown and Yücel (2002). For instance, if consumers expect the short-term effect of a rise in oil prices to exceed its long-term impact on output, they will borrow to smooth consumption, which in turn raises interest rates and reduces the demand for real cash balances. Alternatively, working through the price-monetary transmission mechanism, oil price shocks can reduce investment due to the reduction in producers profit and equally reduces money demand.

The monetary policy channel is another avenue through which monetary authorities' respond to oil price shocks. From Figure 2.1, we observe that tightening monetary policy through increased interest rates to check inflationary pressure caused by increasing oil prices discourages investment and reduces output in the long-term. Evidence from

Bernanke et al. (1997) show that contractionary monetary policy after an oil price shock, leads to further decline in economic activity (Tang et al. ,2010).

2.3.3.5 Sector adjustment effect: estimating the adjustment cost of industrial structure, which is mainly used to explain the asymmetry in oil-price shock impact

The fifth transmission channel works through effects of oil shocks on the labor market by changing relative production costs in some industries. Oil price shocks can increase the marginal cost of production in many sectors that are oil intensive and can motivate firms to adopt new production methods that are less so. This change, in turn generates capital and labor reallocation across sectors that can affect unemployment in the long run. Since the workers have industry specific- skills and job search is time consuming, the labor absorption process tends to take time increasing the level of unemployment. It means higher dispersion of sectoral shocks, causes higher unemployment rates and labor reallocation.

The sector adjustment effect channel, explains the asymmetric impact of oil price shocks within the sectors of an economy. Brown and Yücel (2002) argued that possible explanations for asymmetric sectoral adjustments are monetary policy, adjustment costs, petroleum product prices, and not the supply-side effect. Following an oil price shock, which feeds directly to output, the cost of adjusting to changes in oil prices in each sector of an economy may also retard economic activity. As pointed out by Brown and Yücel (2002) adjustment costs arises due to sectoral imbalances and coordination problems between firms or because the energy-to-output ratio is part of the capital stock. In the case of sectoral imbalances, increasing (decreasing) oil prices would require energy-intensive sectors to contract (expand) and energy efficient sectors to expand (contract). By implication, asymmetry in oil prices will result in underutilization of resources, as Loungani (1986) discussed. If the oil price increases are long-lasting, they can change the production structure and have an important impact on unemployment (Chuku et al. 2010).

2.3.3.6 Unexpected effect: focusing on the uncertainty over oil price and its impact

The last transmission channel suggested by Brown and Yücel (2002) is the unexpected effect, which describes the uncertainty associated with direction of oil prices and their influence on economic activity. Brown and Yücel (2002) Claimed that classical supply side model can explain the inverse relationship between output growth and oil price shocks by reducing the investment demand of firms and consumers', this is referred to as the uncertainty channel. It can clarify the direct relationship between inflation and oil price shocks. However, alone, real balance effect cannot explain the above two relationships.

Uncertainty causes firms and consumers to postpone irreversible investment and consumption decisions respectively (Bernanke 1983; Pindyck 2003). For example, if the energy-to-output ratio is embedded in the capital stock, the firm must choose the energy-intensity of its production process when purchasing capital. For consumers, the uncertainty effect mainly applies to consumer durables, especially energy-using consumer durables. Uncertainty about future oil prices applies to both downward and upward movement in oil prices. Worthy of note is that as future prices become increasingly uncertain, the value of postponing the investment (consumption) decision increases, and the net incentive to invest (consume) decreases thereby dampening long-term prospects of output (Chuku et al. 2010).

2.4 The empirical evidence on the effects of oil prices on the economy

The first part of the literature review considers empirical studies on the effects of oil price changes on economic growth. The second reviews some studies, which have examined the relationship between oil price and monetary policy and, the third analyses the relationship between oil price changes and fiscal policy.

2.4.1 The relationship between oil price and economic growth

2.4.1.1 The Negative Effects of Oil Prices

2.4.1.1.1 <u>Oil-Exporting Countries</u>

Rautava (2004) utilizes a vector autoregressive (VAR) model to test the dynamic relationship between oil price changes and real GDP for the Russian economy. The finding suggests that Russia's real economic growth during the period 1995:Q1-2002:Q4 was negatively influenced by oil price changes. Also, the study of Luthfi et al. (2017) employ a VAR model and show that the impact of oil price is negative on GDP growth in Indonesia. Madueme and Nwosu (2012) use the generalized autoregressive conditional heteroskesticity (GARCH) model to examine the effects of oil price shocks on main macroeconomics indicators in Nigeria. It is determining that oil price shocks have a negative impact on GDP using annual data between 1970 and 2008.

Moreover, Hamdi and Sbia (2013) observes unidirectional causality and significant negative effects from oil revenues to output growth in Bahrain using a VAR approach from the period 1960 to 2010.

2.4.1.1.2 Oil- Importing Countries

Hamilton (1983) in a survey entitled "Oil and the macroeconomy since World War II", uses a Granger Causality test in the US and found that oil price changes are a negative cause of GDP growth. Hamilton (1996) by using Granger Causality test exposed the fact that, in relation to the US economy, oil price changes on macroeconomic performance is negative and statistically significant in relation to GDP over quarterly data from 1948:Q1 to1994:Q2 . Based on monthly data from 1988:03 to 1949:02 Mork (1989) by using Granger Causality test to analysed the relationship between oil price and GDP fluctuation in the US. He found that oil price decrease has a negative effect on GDP. Lee et al. (1995) scrutinize both the unanticipated factor of real oil price changes and the time-varying conditional variance of oil price change by using a generalized autoregressive conditional heteroskedastic (GARCH) model. The result shows a negative effect of real oil price changes on industrial production.

By using a Vector Auto-Regressive model, Burbidge and Harrison (1984) test the effects of oil price on the domestic economy in some OECD countries, US, Japan, Germany, UK and Canada using monthly data for the period 1961:01 to 1982:06. They found the impact of oil-price innovations on output is negative in all countries except Japan. Research by Kim and Willett (2000) consider the relationship between oil prices and economic growth for of OECD countries using various panel data models from 1962 to 1993. In this regard, there is a significant negative relationship between oil price and economic growth. Additionally, using monthly data, Jiménez-Rodríguez and Sánchez (2005) review the dynamic relationship between oil price shocks and real economic activity in selected OECD countries. Multivariate VAR methods present oil prices changes with a larger magnitude of influence on GDP growth than a decrease in oil price; and among oil-importing economies, a rise in oil price has a negative impact on GDP in all cases except for Japan. Furthermore, for the oil exporting countries, the UK is negatively affected by an increase in oil price on GDP growth, but Norway positively during the period from 1972: III to 2001: IV.

Papapetrou (2001) investigates the effect of oil prices on major macroeconomic performance of Greece through monthly frequency over the period 1989:01 to 1999:06 and VAR analysis. The empirical results show that it has negative effect on Greece's GDP growth. Furthermore, by applying a different regime-switching model (RS-R) and a threshold regression modelling (TA-R), Papapetrou (2013) to analyses the impact of an oil price change on economic activity. Using monthly data from Greece during the period from 1982 to 2008 he explains that changes in oil price and high oil price change has a negative significant correlation between oil prices and economic activity strengths during these periods. This result confirms Rasche and Tatom (1981), Darby (1982), Gisser and Goodwin (1986), Hamilton (2003) findings.
By using VARX model employing quarterly data for the period 1982:Q1–2000:Q2 Abeysinghe (2001) explores the oil price effect on open economies (Southeast and East Asian economies, ASEAN4, NIE4, ROECD) both directly and indirectly on GDP growth. The results reveal the transmission mechanism channel between oil price and growth may not be that important for a large economy like the US, but it could play a critical role in small open economies. In other words, the effect of oil prices on GDP growth is negative on Malaysia and Indonesia. By using the annual period between 1961 and 1990, Glasure and Lee (2002) study the impact of oil prices on economic growth in Korea. They found a similar conclusion that there existed a strong negative association between oil price and economic growth. De Miguel et al. (2003) use a VAR model to examine the casual relationship between oil price shocks on economic activity in the Spanish economy for the period 1970:1-1998:4. Again, there is a negative impact of oil price changes on economic growth.

Lee and Ni (2002) discuss oil price shocks' effect on demand and supply in different US industries during the oil crises 1973-74 and 1978-81. Using VAR models, they found that for industries that have a large cost share of oil, shocks principally reduce supply and for many other industries, they principally reduce demand. Amongst all industries, the automobile sector is the most severely affected by oil price shocks. Finally, oil price shocks have a negative influence on US economic activities. An empirical analysis of the effect of oil price fluctuations on GDP growth on US economy has been conducted by Gonzalez and Nabiyev (2009). Focussing on the bivariate correlation between oil prices and GDP growth they use the linear regression model by Mork et al. (1994) for the quarterly data period between 1993:Q3 and 2008:Q3. The result illustrates that America has a negative correlation when prices increase and a positive one when prices decrease. Thus, the U.S.A presented a more sensitive response to oil price increases.

In addition, Raguindin and Reyes (2005) survey the effects of oil price shocks on the Philippine economy from 1981 to 2003. Their VAR model indicates that an oil price shock leads to a negative impact in the GDP growth of the Philippines. Alternatively, negative oil shocks have a significantly greater effect on macroeconomic variables than positive oil shocks. The research of Prasad et al. (2007) extend the vector autoregressive (VAR) model, Cointegration test and Granger causality to analyse the relationship between the international oil price and real GDP using annual data from 1970 to 2005 in the case of a small island economy namely, Fiji. The main results verify that an increase in oil price is negatively related to economic growth.

The relationship between oil price and economic growth using monthly data in small Pacific Island countries (PICs) produced by Jayaraman and Choong (2009) used the autoregressive distributed lag (ARDL) approach for cointegration to examine the long and short-term relationship between variables. Oil price, GDP and international reserve are cointegrated in all four PICs. Additionally, Granger causality test indicated unidirectional causality from oil price and international reserves to economic growth. In overall terms, the findings certify that increases in oil prices negatively affects growth in all four PICs. Similarly, Kiani (2011) in a survey considered the effect of a sharp rise in the price of oil on the Pakistan economy for the period 1990 to 2009. The increase in the oil price has a significant and negative impact on GDP growth.

Tang et al. (2010) apply a Structural vector auto-regressive (SVAR) model to evaluate oil price changes. The results of a causal relationship from oil price shocks to Chinese economic growth indicate that oil price has a negative effect on output based on the monthly data from 1998:06 to 2008:08. Correspondingly, Rasmussen and Roitman (2011) study the dynamic panel interrelationship between oil price and macroeconomic aggregates across the world (144 countries: Oil-exporting countries (19), Oil importing countries (125), OECD based on membership in 1980 (23), low- income countries (66)) over the period 1970-2010. They find that there is a negative impact of oil price increases on GDP in oil importing economies, but the significance of the effect depends on the size of oil imports relative to GDP.

Using a different frequency and method, Bouzid (2012) concentrates on the effects of oil price on the level of real economic growth in Tunisia by using the Unit Root and Granger Causality Tests using a Vector Error Correction Model (VECM). Using quarterly data between 1960 and 2009, this study shows that change in oil price negatively affects the economic growth of Tunisia. Moreover, there is a unidirectional relationship as a causality linkage runs from oil price to economic performance.

2.4.1.2 The Positive Effects of Oil Prices

2.4.1.2.1 Oil- Exporting Countries

Tijerina–Guajardo and Pagán (2003) investigate the impact of oil revenues on GDP growth in Mexico using quarterly data during the period 1981- 1998. Using a VAR model, they indicate that GDP responds to a shock in oil duties. To model the macroeconomic volatilities in four oil exporting countries; Iran, Saudi Arabia, Kuwait, and Indonesia, Mehrara and Oskoui (2007) utilise a structural vector autoregression (SVAR) method suggested by Blanchard and Quah (1988) and extended to open economies by Ahmed et al. (1993), Hoffmaister and Roldós (1997), and Bjørnland (1998). The estimated model points to the fact that oil price shocks are the key and positive source of output fluctuations in Saudi Arabia and Iran, but not in Kuwait and Indonesia.

Using the VAR model Berument et al. (2010) developed empirical studies to define the effects of oil price shocks on real GDP in some net-exporting and importing countries in the Middle Eastern and North African (MENA) region. Results indicate that oil price shocks have a substantially positive effect on growth in Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Syria and United Arab Emirates, of which, with the exclusion of Oman and Syria over the period 1952 to 2004, the majority are OPEC countries. Dées et al. (2008), and Mendoza and Vera (2010) had the same results. Using a similar model Korhonen and Ledyaeva (2010) investigated the effect of oil price shocks on oil-producer and oil-consuming economies utilising quarterly data between 1995:Q3 and 2006: Q3. The main empirical finding is that oil price increases have a positive influence on the oil exporter's output growth. Also, Al-mulali (2010) analysed the influence of oil prices on the GDP of the Norwegian economy using annual data of from 1975 to 2008 and, found that an increase in the oil price caused Norway’s GDP to increase positively.

Jahadi and Elmi (2011) used the Hodrick-Prescott filter to explore oil price shocks on GDP growth performance by using the data between 1970 and 2008 in selected OPEC and OECD countries, adopting a Vector Auto Regression (VAR) approach. The outcome shows that oil price shocks impact the GDP of both OPEC and OECD countries positively although the estimated models show degrees of variation across countries. In this regard, two of the most oil price dependent are the UAE and Nigeria; however, the findings show that Indonesia and Norway have the capability, as oil-exporting countries have the potential to become oil shock independent. Within the OECD, the oil price has a significant short-term effect and using variance decomposition analysis there is evidence that oil price shocks have a substantial positive impact causing economic growth to oscillate. Moreover, Ito (2012) investigates the relationship between oil price changes and real GDP in Russia using quarterly data for the period 1995:Q1- 2009:Q4. The VAR model illustrates that increasing oil prices has a positive impact on economic growth. Generally, the economy is substantially vulnerable to oil price changes. A Vector Error Correction Model (VECM) is employed to test the effects of oil price changes on Algeria. Bouchaour and Al-Zeaud (2012) show that oil prices have a positive impact on real GDP in the long-term.

By employing several methods, Alkhathlan (2013) conducts an analysis on the effect of oil revenue on economic performance in Saudi Arabia using an autoregressive distributed lag (ARDL) framework, covering the period 1971 to 2010. The ARDL bounds test results show that oil revenues have a strong positive impact on economic growth both in the long and short run, and in this positive relationship holds for different specifications of the model. In addition, Asgari (2013) finds that, using the Johansen-Jusilius co integration method, an increase in the oil price in world markets had a substantial and positive effect on Iran's economic growth over the period 1971- 2007. He confirms the Mehrara et al. (2010) discussion, applying a threshold error correction model, on the asymmetric relationship between oil revenue shocks and economic growth in Iran, showing that, in precise terms, the effect of oil revenue is on Iranian real output growth with a rise in oil revenues displaying a positive impact on GDP with a significant effect over the 1959-2007 period.

The study of Omojolaibi (2013) points out that the limited reliance on oil as a source of energy in large and fast-growing economies has made these economies relatively immune to oil price changes. Also, oil price changes has a direct dynamic positive effect on economic growth in the Nigerian economy using data from 1985:Q1 to 2010:Q4 quarterly and a structural vector autoregressive (SVAR) model. Furthermore, Bondzie et al. (2014) attempt to analyse the effects of oil price changes on economic growth in Ghana based on a dynamic stochastic general equilibrium (DSGE) model by Christiano et al. (2001), (2005) and shows a positive effect in output from 1961 to 2012.

Others like Esfahani et al. (2013) develop the relationship between oil exports and the Iranian economy by applying a new quarterly data set during the period 1979:Q1-2006:Q4. The vector error correcting (VEC) model results indicate that real output in the long run is affected by oil exports and foreign output. Also, there is an important negative long-run influence of inflation on real GDP. In fact, the Iranian economy stabilises quite rapidly to the shocks in foreign output and oil exports, which could be partly due to the relatively underdeveloped nature of Iran's financial markets. In general, findings are positive and supportive of the long-run theory developed in Esfahani et al. (2014) for major oil exporting economies.

Cashin et al. (2014) use Global VAR (GVAR) methodology to study the international transmission of oil price shocks and their macroeconomic effects through some selected OPEC and OECD countries. In response to an oil-demand disturbance, almost all countries in our sample experience, within the quarterly data period between 1979:Q2 and 2011:Q2, a long run positive effect in real output. During the period 1971 to 2012 Shafi and Hua (2014), by employing ECM econometric modelling in the Russian economy, indicate that there is a positive impact of oil prices on economic growth. Additionally, Kuboniwa (2014) presents a vector error-correcting macroeconometric model to estimate the direct effect of oil prices on output growth in three emerging Pacific Rim economies (Russia, Malaysia and Indonesia). The main results show that there is a positive effect between changes in output and oil prices and between changes in GDP and energy efficiency (EF). Furthermore, the influence of oil prices on economic growth through the terms of trade (ToT) and energy efficiency (EF) channel in Russia and Malaysia is positive although negative in Indonesia. In conclusion, oil prices have a positive influence on EF in all three countries.

Boheman and Maxén (2015) investigate how oil price shocks affect output growth in 11 OPEC and 8 non-OPEC countries during the period of 1980-2008 using a Vector Autoregression (VAR) approach. The results indicate that OPEC, the price setters, and non-OPEC oil exporting countries' are equally sensitive to oil price shocks. Therefore, the relationship among oil price shocks and economic growth is positive for developing oil-exporting countries. The causal relationship between oil prices and economic growth is measured through a frequency approach .This work is based on a monthly time series from 2000 to 2010 for four major countries (United Arab Emirates, Kuwait, Saudi Arabia, and Venezuela) by the Organization of the Petroleum Exporting Countries OPEC (2015). Both OPEC and Ftiti et al. (2016) found that oil price shocks cause a significant positive effect between oil price and economic activity growth in OPEC countries.

*2.4.1.2.2 **Oil- Importing Countries***

By using VAR and VECM models, Chang and Wong (2003) show that the impact of oil price shocks on Singapore's economic growth is only marginal during the period 1978:Q1 to 2000:Q2. Research by Lardic and Mignon (2006) analyses the time series behaviour of oil prices and GDP by applying a linear cointegration framework and using quarterly data from 1970:Q1 to 2003:Q4. Their empirical review of 12 European countries has shown that oil prices have a positive long run relationship with the economic activities in them. Hanabusa (2009) study, using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model and, monthly data in the period 2000:07- 2008:03, is used to find crude oil price and real economic growth in Japan. The empirical findings demonstrate that, using the Granger Causality test, there is a positive relationship between changes in the mean and variance of real GDP growth and that of the change of oil price mean and variance.

Lorde et al. (2009) evaluate the relationship between oil price changes and real economic output in the small open oil-producing country, namely Trinidad and Tobago (T&T). The estimation suggests that there is positively causality between oil prices and output. According to the significance of the positive responses, shocks to oil price changes tend to yield smaller macroeconomic impacts in comparison to shocks to oil prices. Moreover, Holscher et al. (2008) examine the determinants of Chinese oil demand and to build a short and long-run model between 1978 and 2000. The findings show that only vehicle numbers and real GDP are determinants of the positive demand in the short-run. The model also shows that there is a fairly slow adjustment from the short-run to the long-run model.

The dynamic links between oil price shocks and oil-consuming economies were studied by Korhonen and Ledyaeva (2010) employing quarterly data from 1995:Q3 to 2006:Q3.

For oil consumers, the VAR model effects are more diverse. In some countries, output falls in response to an oil price shock, while other countries seem to be relatively immune to oil price changes. Furthermore, indirect effects are also detected for oil-consumer countries. Those countries, which trade more with oil producers, gain indirect benefits through their higher demand from oil-producing countries. Overall, the largest negative direct effect of a positive oil price shock is established for Japan, China, the USA, Finland and Switzerland. The indirect effects are positive for Russia, Finland, Germany and Netherlands. Accordingly, many European countries would be relatively unharmed by the recent positive oil price shocks.

The studies of Chang et al. (2011) examine the relationship between oil price volatility and GDP in ASEAN countries. The results of the vector autoregression model (VAR) and a vector error correction model (VECM) indicate that oil price has a considerable positive role in influencing the country's GDP. In fact, GDP for oil exporting nations are positively impacted by a rise in oil price in the long-run. It finds that economic performance recovers for small and open economies in the long-run, after a short-run initial slowdown in GDP as a result of an oil price shock. Correspondingly, Gausden (2013) demonstrates the impact of the price of oil on UK macroeconomic performance using a vector autoregressive (VAR) model. According to quarterly data from 1972 to 2008, the results show that there are noteworthy positive effects between the oil price movements and macroeconomic activity.

Based on quarterly data between 1988:01 and 2013:04, Kargi (2014) appraises the long term relationship between economic growth and oil prices in Turkey. For this purpose, two-stage Engle-Granger cointegration test, Johansen Juselius cointegration test and a Granger causality test were employed. The results show that GDP growth is affected positively in the Turkish economy.

2.4.1.3 Not Significant Effects of Oil Prices

2.4.1.3.1 Oil- Exporting Countries

In defining the nexus between oil price volatility and key macroeconomic variables in the Nigerian economy Ayadi (2005) reveals that increases in oil prices between 1980-2004 do not directly result in an improvement in industrial production. In addition, using quarterly data over the period of 1970 to 2000, Akide (2007) tests the effect of oil price changes on output growth and the results indicate that oil price changes do not affect output in Nigeria.

Akpan (2009) describes the dynamic relationship between oil price shocks and Nigeria's economic activity during the period 1970 to 2007. According to the specific modelling VAR methodology, he finds that oil price shocks do not effect industrial output; the evidence also shows a marginal influence of oil price fluctuations on industrial output growth. The study of Berument et al. (2010) evaluate the effects of oil price shocks on the growth of economic activities in some net-exporting and net-importing countries in the Middle Eastern and North African (MENA) region. The research is conducted using a VAR model and covers the period 1952 to 2004. Results indicate that there was no impact on the net importing economies of Bahrain, Djibouti, Egypt, Israel, Jordan, Morocco and Tunisia as a result of oil price shocks. Similar results were also presented by Dées et al. (2008), and Mendoza and Vera (2010).

Iwayemi and Fowowe (2011) examined, employing the VAR method, how oil price shocks affected the Nigerian economy in order to characterize the relationship between oil price shocks and GDP. Using quarterly data between 1985:Q1 and 2007:Q4, they found that oil price shocks do not have a major impact on most macroeconomic variables in the Nigerian economy. Gudarzi Farahani et al. (2012), making use of the flexibility available in the Autoregressive Distributed Lag (ARDL) model, sought to explain the long run relationship between oil price and economic growth in Iran between 1980 and 2010. The results failed to find any causality or relationship between economic growth and oil prices. Using data for Nigeria between 1970-2003 and VAR methodology, Olomola (2006) and Olomola and Adejumo (2006) claim that there is no considerable effect of oil price shocks on output growth. Thus, the findings of a number of researchers using different methodology find little relationship between output growth and oil price shocks.

2.4.1.3.2 <u>Oil- Importing Countries</u>

Hess (2000) finds that oil price shocks led to lower real economic growth prior to the 1980s. His estimates show that oil price increases have no direct effect on US economic activity. Employing cointegration and Granger causality tests, Cunado and De Gracia (2005) examine the impact of oil price shocks on economic growth rates for some Asian countries applying quarterly data between 1975:Q1 and 2002:Q2. The experimental findings suggest that there is no cointegration relationship between oil prices and economic activity in the long-run, however, an oil price shock has a negative impact on GDP in the short run. Similarly, Gonzalez and Nabiyev (2009) research the dynamic links between oil price fluctuations and real GDP growth on the Swedish economy. The findings, based on quarterly data from 1993:Q3 to 2008:Q3 does not indicate any pattern of a negative relationship between GDP growth and real oil price increases.

The use of a Bi- variate VAR framework and Granger Causality to estimate the nexus between real crude oil price changes and economic growth in India between 2000:04 and 2010:03 show that there is no causal relationship of crude oil price variation on GDP (Saxena and Bhadauriya 2012). There are fewer experimental studies for developing countries . However, Edirneligil and Mucuk (2014) found that the consequences of oil price changes on the growth of the Turkish economy between 1980 and 2013 there is no long run relationship between oil prices and economic growth. Although, there is a negative impact of oil price shocks on GDP in the short run. The study of Trang et al. (2017) confirm those findings for Vietnam.

Wang et al. (2012) using a VAR model measure oil price fluctuations and China's economy using monthly time series from 2000 to 2009. Their empirical findings indicate that there is no effect on the long-term stability of its economic growth.

2.4.1.4 The Asymmetric Effects of Oil Prices

2.4.1.4.1 Oil- Exporting Countries

The study by Iwayemi and Fowowe (2011) consider the dynamic relationship between oil price shocks and output growth in Nigeria using a VAR model. They find that the magnitude of a negative oil price shock on GDP is larger than that of a positive oil price shock. This is similar to the results achieved by Mehrara (2008) and implies that negative oil shocks dominate positive oil shocks. In fact, Mehrara (2008) analyses the asymmetric effect of oil revenues on output growth in 13 oil exporting countries using a dynamic panel framework and two different measures of oil shocks. The data obtained from 1965 to 2004 show that oil revenue shocks tend to effect gross domestic output in asymmetric or nonlinear ways. A study by Berument et al. (2010) from 1952 to 2004 on the effects of oil price shocks on GDP growth in the Middle East and North Africa (MENA) found that the evidence certified the existence of an asymmetric nexus between

GDP and oil price. Similar outcomes were obtained by Dées et al. (2008), and Mendoza and Vera (2010).

2.4.1.4.2 Oil- Importing Countries

Hamilton (2001) and Mory (1993), using a non-linear methodology claim the existence, in the US, of an asymmetric relationship between oil price changes and output growth when the annual data sample is extended beyond 1951 to 1990. The same non-linear model was used by Zhang (2008) employing the Hamilton (2001) time series framework with a data set of quarterly observation for the 1957:Q1-2006:Q4 period, and applying an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model to study the effect of oil price shocks on the long run economic growth in Japan. The results indicate that the oil price changes and macroeconomic activities in Japan seem to be affected by these nonlinear relationships and can be shown to be asymmetric.

Cuñado and de Gracia (2003) evaluate the dynamic relationship between oil prices and production growth rate in many European countries using quarterly data between 1960 and 1999. The finding illustrates that there is an asymmetric effect on production growth rates by using Granger causality and structural stability tests. Lardic and Mignon (2008) concentrate on the long run effect of oil prices on economic performance focussing on the G7, Europe and Euro area countries based on an asymmetric cointegration framework, expanded by Balke and Fomby (1997), Enders and Dibooglu (2001), Enders and Siklos (2001) and Schorderet (2003). In this regard, there is evidence of asymmetric cointegration amongst oil prices and GDP.

Generally, oil shocks are exogenous and are able to cause macroeconomic fluctuations. In order to examine the ability of different Markov–Switching methods to capture business cycle asymmetries and, to evaluate the effect of oil price shocks on mean level growth rate, Cologni and Manera (2009) analyse business cycle dynamics in the real GDP series for the G-7 countries. The empirical findings show that oil shocks tend to be asymmetric according to quarterly data over the period 1970:Q1 to 2005:Q1. By using different frequency and model, Jimenez-Rodriguez (2008) argues empirically the impact of oil price shocks on economic industries in six industrialized OECD countries, namely France, Germany, Italy, Spain, UK and US by considering a bivariate VAR for disaggregated data at industry level, monthly from 1975 to 1998. The pattern showed that the response to oil price shocks is different across the four European Monetary Union

(EMU) countries being evaluated (France, Germany, Italy, and Spain). On the other hand, it is similar in the UK and the US. Furthermore, it is found that the dynamic effect of oil price changes, as a result of heterogeneity, react differently across industry sectors within the EMU countries and therefore any application of economic policy should take cognisance of this fact.

By applying VAR analysis, Du et al. (2010) estimate the impact of oil price shocks on China's macro-economy over the monthly data period from 1995:01 to 2008:12. The finding displays that the impact of international oil price on China's GDP is asymmetric. During the quarterly data over the period 1976:Q1–2008:Q2, Jimenez-Rodriguez and Sanchez (2012) explain the performance of oil price shocks in Japanese economy. Thus, non-linear effects of oil prices do not appear to lower economic activity and there is very limited evidence of oil-induced industrial slowdowns.

Furthermore, Schubert and Turnovsky (2011) carry out a study of a small oil-importing developing economy using a dynamic stochastic general equilibrium (DSGE) model in order to estimate the dynamic relationship between an increase in the price of oil and the longer-run growth and output activity. The evidence indicates that the effects of the recent oil price shocks has a moderate impact on economic growth. In conclusion, there is an asymmetric effect of oil price shocks for developing countries on output growth.

2.4.2 The effects of oil prices on inflation, interest rates, exchange rates and unemployment

2.4.2.1 The Negative Effects of Oil Prices

2.4.2.1.1 Oil- Exporting Countries

Al-mulali (2010) attempts to shed light on the nexus between oil prices and real exchange rate for Norway based on annual data from 1975 to 2008. The VAR model results illustrate that oil price increases its competitiveness to trade as a result of real exchange rate depreciation.

A Vector Error Correction Model (VECM) is utilized by Bouchaour and Al-Zeaud (2012) and they find a negative impact of oil prices on real effective exchange rates and unemployment in the long run in Algeria. In a VAR framework, Ito (2012) inspects the oil price and macroeconomy relationship by means of analysing the impact of oil price changes on the levels of inflation and real effective exchange rate for Russia using quarterly data for the period 1995:Q1- 2009:Q4. The empirical results confirm that increasing oil prices not only stimulates a negative effect on inflation but also induces real effective exchange rate appreciation in the short run. In this regard, the findings indicate that Russia should diversify its core industries and develop the competitiveness of non-energy sectors by increasing foreign direct investment (FDI) from the rest of the world. This, it was suggested, could be driven by the improving the investment environment through World Trade Organization (WTO) accession.

On the other hand, the Johansen-Jusilius cointegration method is used by Asgari (2013) to analyse the relationship between oil price and inflation rates in the Iranian economy in the period 1971-2007. The results show that there is a negative relationship between the inflation rate and world oil prices which influences negatively economic growth. Using another model, the impact of structural shocks of oil prices on levels of economic activity in Ghana was investigated by Bondzie et al. (2014). This analysis followed Christiano et al. (2001; 2005) and utilised a dynamic stochastic general equilibrium (DSGE) model using annual data from 1961 to 2012. The findings indicate that a negative shock on interest rates leads to a sharp fall in prices, which impacts marginal cost. The effect is that inflation falls more. Indeed, there is a paradoxical effect of a negative interest rate on total money supply. Also, the study of Luthfi et al. (2017) finds that the impact of oil price is negative on inflation, interest rate and unemployment in Indonesia.

2.4.2.1.2 Oil- Importing Countries

The research of Chang and Wong (2003) assesses empirically the effects of oil price fluctuations on Singapore's macroeconomic performance. The period of the study is from 1978:Q1 to 2000:Q2 and employs a general to specific by modelling vector autoregression (VAR) and vector error correction model (VECM) techniques. Findings suggest that the oil price shocks adversely negative affect Singapore's inflation and unemployment rates.

Using a monthly data between 1992:01–2005:12, Faria et al. (2009) show that oil price has a negative effect on real exchange rates in Chinese economy. Du et al. (2010) evaluate, using VAR analysis, the causal relationship between oil price shocks and China's macro-economy utilising monthly data from 1995:01 to 2008:12. The results indicate that the world oil price has a significant and negative effect on inflation in China;

however, China's economic growth and inflation position fail to affect world oil prices. Additionally, Tang et al. (2010) use a Structural vector auto-regressive (SVAR) model and compute impulse responses to oil price changes according to monthly data for the period 1998:06- 2008:08. The findings show that there is a negative effect of the oil price on investment in China.

Lizardo and Mollick (2010) evaluate how the value of the US dollar exchange rate reacts to fluctuations in world oil prices using a VAR model. Monthly data for the period 1970-2008 is utilized. Accordingly, results indicate that oil prices contribute to the explanation of movements in the value of the USD in the long-run. On the whole, a rise in the real price of oil leads to a significant depreciation of the USD against net oil exporter countries such as Canada, Mexico, and Russia. However, the currencies of importers of oil, such as Japan, depreciate relative to the USD when the real price of oil increases.

2.4.2.2 The Positive Effects of Oil Prices

2.4.2.2.1 Oil- Exporting Countries

The impact of changes in oil prices on real exchange rate dynamics on the Russian economy has been reviewed by Rautava (2004). The results of vector autoregressive (VAR) modeling and cointegration techniques show that the Russian economy is influenced positively significant by oscillations in oil prices and the real exchange rate is influenced through both long-run equilibrium conditions and short-run direct positive impact. Ayadi (2005) surveys the relationship between oil price changes and macroeconomics in Nigeria, using a VAR estimator to determine the interrelationships between variables. Oil price changes affect real exchange rates positively between 1980 and 2004, which, in turn, affect industrial production. He verifies Olomola (2006) and Olomola and Adejumo (2006) audits of quarterly data covering 1970-2003 periods and the positive impact of oil price shocks on Nigerian macroeconomic performance. However, oil price shocks are a vital contributor to real exchange rates and the long run money supply, and it is money supply rather than oil price shocks that affects output growth. The consequence is that a high real oil price will increase and positive effect on national wealth thus creating an environment, which influences the real exchange rate causing it to appreciate. This was emphasised by Madueme and Nwosu (2012) who, by applying the generalized autoregressive conditional heteroskesticity (GARCH) model find that there is a statistically significant and positive effect of oil price shocks on exchange rate in Nigerian economy from 1970 to 2008.

Additionally, Akpan (2009) adopted a general to specific VAR modelling approach to examine the relationship between oil price shocks, inflation, exchange rate and imports on the Nigerian economy over the period 1970 to 2007. The empirical results prove that oil price shocks have a significant positive capacity to increase inflation and contribute directly to a rise in real national income. Farzanegan and Markwardt (2009) also employ a VAR model to examine the dynamic effects of oil price shocks on the Iranian economy from 1989 to 2006. The results show that positive oil price shocks lead to a significant increase in the real effective exchange rate. Additionally, the effects of positive and negative oil price shocks have a significant influence on the rise in inflation. Also, Bouchaour and Al-Zeaud (2012) analysed the effects of oil price fluctuations on Algerian economic development. A Vector Error Correction Model (VECM) is applied on a vector of macroeconomic variables between 1980 and 2011. The results indicate that oil prices have a minor impact on the majority of key variables in the short term with the exception of inflation where the effect is positive.

Omojolaibi (2013) studies the effects of oil price changes on the macroeconomic dynamics of Nigeria using a structural vector autoregressive (SVAR) technique using quarterly data from 1985:Q1 to 2010:Q4. The results indicate that domestic policies and not oil-booms should be blamed for inflation. However, oil price variations are determined primarily by oil shocks with domestic shocks having a reasonable positive influence. Accordingly, oil price changes are the key cause of macroeconomic changes in Nigeria. Generally, oil shocks have moderately direct positive effect on money supply and no important influence on price levels. Recently, Shafi and Hua (2014) attempt to find the effect of oil prices and exchange rate volatility on economic growth in the Russian economy based on an ECM econometric model. During the period of 1971 to 2012, the result shows that there is a positive impact of oil prices on the exchange rate. Additionally, imports, exports, inflation, interest rate and foreign direct investment have a substantial influence on real effective exchange rate in both the short and long-run. In the empirical work of Mork et al. (1994) they determine that oil price change has positive effect on inflation in African countries. The results are confirmed in work by Lacheheb et al. (2019), Bass and Policy (2019) and Trang et al. (2017).

2.4.2.2.2 ***Oil- Importing Countries***

Hamilton (1983) determines, employing Granger causality, that oil price changes have a positive correlation with unemployment from 1948 to 1988 in the USA. Using Hamilton's data Gisser and Goodwin (1986) draw similar conclusions to Hamilton (1983) and this is also the conclusion of Burbidge and Harrison (1984). Amano and Van Norden (1998a), (1998b) attempt to demonstrate the relationship between the real oil price and real effective exchange rates for Germany, Japan, and the US over the post-Bretton Woods period. The experimental findings show that the real oil price is the major positive factor determining real exchange rates in the long-run. By using quarterly data for many European countries over the period 1960–1999, Cuñado and de Gracia (2003) review the oil price–macroeconomic relationship by means of studying the impact on the oil price and inflation rate relationship. They start by analysing the time series properties of the data, which they follow by applying a Granger causality and structural stability test to the differing databases for each country. They found that there was a universality in the results showing that oil prices have permanent and positive effects on inflation. However, each country demonstrates a different reaction beyond the inflationary effect to these shocks.

In an extension of this analysis to other countries, Chen and Chen (2007) analyse the impact of oil prices on real exchange rates for G7 economies (Canada, France, Germany, Italy, Japan, the UK, and the US), by utilizing monthly Panel cointegration data from 1972:1 to 2005:10. The study reveals that real oil prices have a significant positive effect on real exchange rate. On the other hand, Cologni and Manera (2008) use a structural cointegrated VAR and VECM model to investigate the interaction between oil price shocks and monetary variables for the G-7 countries during the 1980-2003. They find a temporary positive impact of monetary policy shocks on inflation rate. In addition, a stationary money demand can be identified for most countries and inflation rate shocks are transmitted to the real economy by increasing interest rates. Moreover, there is a temporary effect of oil price innovations on prices, which creates a different monetary policy response to inflationary, and growth shocks.

Using monthly data from 1982:12-2006:05 and the Johansen cointegration and Granger causality tests Ozturk et al. (2008) examined the dynamics of the impact of oil prices and the exchange rate in Turkey. The Granger Causality test result indicates that real crude oil prices have a positive significant effect on the USD/YTL real exchange rate. Using a different approach, Doğrul and Soytas (2010) study the causal relationship between oil prices, unemployment rate and real interest rates in an emerging market, namely Turkey. The empirical analysis utilises a data series from 2005:01 to 2009:08 using the Toda–Yamamoto (TY) procedure (Toda and Yamamoto 1995) to test for a long run Granger causality between the series. They find that in the long-run real oil price and interest rates have a positive effect on Turkish unemployment whilst also suggesting that labor is a proxy for capital and energy.

Andreopoulos (2009) using data from 1953:02 to 2007:02 and applying the Markov Switching Vector Autoregression finds that the real price of oil is only effective in recession in forecasting unemployment and that oil, but not the real rate, has a positive significant effect on unemployment in the long-run. Quarterly US recession's duration. Similarly, Wu and Ni (2011) examine the dynamic relationship between oil prices, inflation, interest rate and money in US using monthly data from 1995:01 to 2005:12 and a variety of lagged variables. The empirical findings are still quite robust given the use of the various lag-chosen criteria, symmetric and asymmetric models, and the diversity of the time series models used. The results indicate that oil price changes in both symmetric and asymmetric models influences inflation positively but the reverse is also true indicating that monetary policies also affect oil prices. Tang et al. (2010) study the relationship between oil prices and major monetary variables in the monthly period of 1998:06-2008:08. Using a Structural vector auto-regressive (SVAR) model they suggest that the oil price has a positively effect on inflation and interest rates in the Chinese economy. Wang et al. (2012), using VAR methodology, found that oil price change was the most significant positive cause of the changes of price levels, unemployment and monetary policy in the Chinese economy. Additionally, they found, by using cointegration and stability tests that there existed a long term steady cointegration relationship amongst the macroeconomic variables utilised across the periods 2000 to 2009 and quarterly periods covering 1990:Q1-2010:Q4.

Bencivenga et al. (2012) perform a Vector Error Correction Model (VECM) analysis, in order to evaluate the relationship between West Texas Intermediate (WTI) crude oil spot prices and a set of US macroeconomic and financial variables using a monthly time series between 1993 and 2009. They find that, overall, exchange rates, gold prices, US interest rates, US oil imports and oil futures play a statistically significant and positive role in the long-run.

Moreover, Jimenez-Rodriguez and Sanchez (2012) study the role of oil price shocks in the Japanese economy employing quarterly data from 1976:Q1–2008:Q2. Using a VAR model, they found that the non-linear effects of oil prices contributed to rising inflation. Saxena and Bhadauriya (2012) study, using monthly Indian data 2000:04-2010:03 examined the relationship between change in real crude oil price and macroeconomic indicators. In a Bi-variate VAR approach and Granger Causality test, it can be concluded that inflation in India was found to have a positive effect with international crude oil prices.

Ahmad (2013) employs the Toda–Yamamoto causality test to explore the relationship between unemployment and two input prices, namely energy (real oil prices) and capital (real interest rate) in Pakistan. This study collects monthly data over the period from 1991:01- 2010:12 (238 observations). The result indicates that there is a significant positive effect of oil prices on unemployment, but it does not find a significant association between real interest rate and unemployment, accordingly findings of this study are only partially consistent with the efficiency wage model. Moreover, real oil prices cause significant positive changes in the real interest rate in Pakistan. This finding supports the fact that oil prices contribute to forecasts of unemployment and real interest rate in long run.

In recent times, Kargi (2014) studies the long term relationship between inflation rate and oil prices in the Turkish economy based on a quarterly data between 1988:01 and 2013:04. Two-stage Engle-Granger cointegration test, Johansen Juselius cointegration tests and Granger causality test were utilized and he found the inflation and oil imports have a positive effect on the Turkish economy. Moreover, Cashin et al. (2014) employ a Global VAR (GVAR) approach to investigate the international transmission of oil price shocks and their macroeconomic effects across a wide range of 38 countries (selected OPEC and OECD). Consistent with quarterly data period between 1979:Q2 and 2011:Q2, the economics of a supply- oil price shock are very different from those of an oil demand shock both of which are influenced by global economic activity. The reaction also varies between importers and exporters with the former experiencing a reduction in economic activity whereas the impact is positive for the latter. In response to an oil-demand disturbance, almost all countries in their sample experience long-run inflationary pressures, a rise in interest rates, and a decrease in equity prices.

2.4.2.3 Not Significant Effects of Oil Prices

2.4.2.3.1 Oil- Exporting Countries

In the case of the Algerian economy Bouchaour and Al-Zeaud (2012) illustrate, employing series data from 1980 to 2011 and a Vector Error Correction Model (VECM), that there is no effect of oil price volatilities on money supply which confirms Mork et al. (1994) claim that there is no effect of oil price volatilities in domestic money supply in the African economy.

2.4.2.3.2 Oil -Importing Countries

Chang et al. (2011) review the impact of oil price fluctuations on inflation and unemployment for countries in ASEAN, the Asia-Oceanic region and South Asia. The results, using a vector autoregression model (VAR) and a vector error correction model (VECM) show that there are no clear patterns in the relationship between oil price fluctuations, inflation and unemployment. Also, Trang et al. (2017) show that the impact of oil price on unemployment is unclear in Vietnam.

2.4.2.4 The Asymmetric Effects of Oil Prices

2.4.2.4.1 Oil Importing Countries

Cunado and De Gracia (2005) investigate the oil price and macroeconomy relationship by means of studying the impact of oil price shocks on inflation for six Asian countries using quarterly data for the period 1975:Q1-2002:Q2. The cointegration and Granger causality tests are implemented in this research. As a result, while standard cointegration is rejected, there is evidence for asymmetric cointegration between oil prices and inflation rates for Japan, Thailand, South Korea and Malaysia. In South Korea, the relationship between oil price changes and economic growth was analysed and found to be consistent with the other result.

Ghosh (2011) using a generalized autoregressive conditional heteroskedasticity (GARCH) and exponential GARCH (EGARCH) frameworks analysed the impact of oil price on exchange rate on the Indian economy based on daily data for the period July 2, 2007–November 28, 2008. It was concluded that a rise in the oil price return leads to the depreciation of Indian currency versus the US dollar. Moreover, findings show that oil price shocks have a symmetric and permanent effect on exchange rate volatility. The results are confirmed in later work by Nusair and Olson (2019).

2.4.3 The effects of oil prices on government spending and income

2.4.3.1 The Negative Effects of Oil Prices

2.4.3.1.1 <u>Oil- Exporting Countries</u>

Reyes-Loya and Blanco (2008) analysed the connection between oil revenues and total fiscal income by estimating An Autoregressive Integrated Moving Average (ARIMA) model using 1990:01-2005:12 monthly data on government spending, tax revenues, oil revenues and industry production index in Mexico. Fundamentally, they found that there is an inverse negative relationship between oil-related revenues and tax revenue from non-oil sources. Applying annual and monthly data on a sample of 17 key oil producers between 1961 and 2013, El-Anshasy et al. (2015) use a standard panel autoregressive distributed lag (ARDL) approach and cross-sectionally augmented version (CS-ARDL) to examine oil revenue, volatility and economic growth. They conclude that whilst oil revenue increases economic growth rate volatility impedes that development. However, this is exacerbated by poor fiscal responses to this volatility, which in turn is the main cause of the resource curse paradox. Therefore, overall, better fiscal policy (institutions) can neutralize some of the negative effects of oil revenue volatility.

2.4.3.1.2 <u>Oil- Importing Countries</u>

A study was conducted of the nexus between oil prices and current account balances on the Turkish economy by Özlale and Pekkurnaz (2010). The structural vector autoregression SVAR model using monthly data from 1999:09 to 2008:09 establishes that there is an important effect of oil price shocks on the Turkish current account in the short-run. In addition, the finding proves that the oil price shocks parameter is found to be negative and statistically substantial.

2.4.3.2 The Positive Effects of Oil Prices

2.4.3.2.1 Oil- Exporting Countries

Farzanegan and Markwardt (2009) evaluate the effects of oil price shocks on key macroeconomics variables in Iran over the period 1989 to 2006 employing a VAR methodology. They conclude that there is an asymmetric effect in terms of oil price volatility with both positive and negative shocks increasing inflation but with positive shocks increasing industrial output. However, the relationship between oil price changes and government spending is only marginally important over. Similarly, Hamdi and Sbia (2013) conducted a short and long-run dynamic study of the positive relationship between oil revenues and government expenditures in the oil-dependent Bahraini economy for the period 1960 to 2010. Using, the cointegration analysis and error-correction model, their results reveal that oil revenues and government expenditures are statistically significant and positive for both long and short-term periods. Essentially oil revenue is the main source of government revenues and total finance spending in the Kingdom of Bahrain. Research by Akpan (2009) defines the effects of the asymmetric effects of oil price shocks on Nigeria’s economic performance during the period 1970 to 2007. There is a durable positive nexus between positive oil price changes and real government expenditures.

Madueme and Nwosu (2012) examine the effect of oil price shocks on capital expenditure using a generalized autoregressive conditional heteroscedasticity (GARCH) model from annual data for 1970 to 2008. The finding reveals that oil price shocks have a significant positive influence on capital expenditure in the Nigerian economy.

Moreover, Farzanegan (2011) studies the effects of oil revenues shocks on various elements of the spending behaviour of the Iranian government between 1959 and 2007 using a multivariate unrestricted vector autoregressive (VAR) model including an impulse response function (IRF) and variance decomposition analysis (VDC). The findings indicate that the government's military and security expenditure have reacted to shocks in oil revenues positively. Also, using Panel regression Farzanegan (2018) finds a positive effect of higher oil rents on military spending: this effect is larger in the corrupt countries within non-Gulf Cooperation Countries (GCC). The results is confirmed by Farzanegan and Krieger (2018) and Farzanegan (2017).

Dizaji (2014) deliberates the effects of oil shocks on the dynamic relationship between government revenues and government expenditures in the case of an oil-dependent economy; Iran. In addition, this research proposes to examine two different categories of variables for two different time periods with three different methodologies. Using a Structural Vector Autoregression (SVAR) model with annual data between 1970 and 2008 the first group of variables consist of oil prices, oil revenue to GDP ratio, government total expenditure to GDP ratio and a dummy variable for capturing the effects of war between Iran and Iraq are considered as a first group of the variables which measured the effect on government expenditure. The second group of variables include oil revenues, government total revenues, government current and capital expenditures, money supply and CPI employing the unrestricted Vector Autoregression (VAR) and Vector Error Correction (VEC) methods using quarterly data over the period 1990:2–2009:1. The results indicate that the role of oil revenue shocks is stronger than the effect of oil price shocks in relation to the government's total expenditures. The results from the VAR and VEC estimators indicate a strong positive causality between shocks to oil revenues and changes to in government total revenues and government current expenditures. Also, there is a strong positive causality from government revenues to government expenditures (both current and capital) in the Iranian economy. This indicates that sanctions can influence the government total expenditures as they reduce the Iranian government's oil export revenue.

Based on an ECM econometric technique Shafi and Hua (2014) review the effect of oil prices and exchange rate volatility on economic growth in the Russian economy. The empirical findings indicate that government consumption expenditure has a significant positive response in relation to the real effective exchange rate in the long and short run. Moreover, Eltony and Al-Awadi (2001) use a vector autoregression model (VAR) and a vector error correction model (VECM) and quarterly data from 1984 to 1998 to estimate the consequences of oil price changes on the economic growth of the Kuwaiti economy. The empirical results show that the VECM contributes superior results as it provides a more rapid interaction between macroeconomic variables than does the VAR estimation. Overall, the VECM approach is closer to an intuitive view of the interpretation of the results. The findings illustrate that there is a striking degree of interrelation between the key macroeconomic variables. There is also evidence that oil price shocks and oil revenues have a significantly positive effect on macroeconomic variables effect through government development and current expenditure. In fact, it accentuates the causality running from oil prices and oil revenues, and the impact on government development and current expenditure and then on to other variables. The variance decomposition estimation of government spending indicates that oil revenue change has a remarkably dynamic positive effect on development expenditure, which is a significant element in the circular flow of the economy. Furthermore, CPI has an important positive role in both kinds of government spending. However, oil revenue and government development expenditure changes have been emphasized in accounting for any variation in the value of imports.

El-Anshasy and Bradley (2012) find that the fiscal expenditure of oil exporting economies has been exclusively dependent on oil balances or export revenues. In this context, Alley (2016), finds that expenditure has the same level of positive change as revenue whilst Jimenez and Tromben (2006a) claim that the former is in fact more volatile than the latter. They are both the main development channel for transmitting oil price shocks to the domestic economy (Pieschacon 2009), Ismail and Arezki 2010). Moreover, fiscal volatility has been higher for oil dependent countries than those whose fiscal policies are less dependent on export revenues (Alesina and Tabellini 2005; Jimenez and Tromben 2006b). Therefore, extensive research has identified that fiscal policies are subject to oil price change.

2.4.3.2.2 Oil- Importing Countries

Lorde et al. (2009) employed a Vector autoregressive (VAR) analysis to study the effects of oil price changes on main macroeconomic aggregates in the small open oil-producing country of Trinidad and Tobago (T&T). Their empirical findings illustrate that the price of oil is a major determinant of economic activity of the country and therefore there is positive causality between oil prices and government revenue, which becomes the key channel through which oil prices affect the macroeconomy in the short run. Furthermore, gross investment, government consumption, government revenue and the average price-level increase following an oil price shock and also innovation to oil prices leads to a substantial increase in the value of net exports. Also, an unanticipated shock to oil price change brings about random oscillations in the macroeconomy; although, only government revenue and the price level demonstrate these responses.

Saxena and Bhadauriya (2012) investigate the effect of international oil price on key macroeconomic factors in India based on monthly data over the 2000:04-2010:03. The results from estimating a Bi- variate VAR framework and Granger Causality test suggest that the position of forex reserves and balance of payments have a significant impact on international crude oil prices. However, a study of the physical determinants of the real price of the crude oil market on the current account for Turkey's economy by Mucuk et al. using VAR model and monthly data from the period 1992:01-2013:02, finds that there is a positive causal relationship between oil prices and the current account deficit in the long-run.

2.4.3.3 Not Significant Effects of Oil Prices

2.4.3.3.1 Oil- Exporting Countries

Tijerina–Guajardo and Pagán (2003) empirically examine the dynamic relationship between oil revenues, taxes and total government expenditures in Mexico, using the quarterly data from 1981 to1998. The results from estimating a VAR model are that oil revenues have a negative effect on tax revenues but there is no reverse causality. Additionally, both government spending and economic growth have a positive impact on tax revenue shocks and also tax revenues and oil duties do not respond to government spending innovations. In other words, the substitution effect between oil duties and tax revenues suggest that tax revenues are not able to absorb intertemporal declines in oil duties. Empirical evidence for the resource curse was originally presented by Farzanegan (2011) who found that government social expenditure did not display a substantial response to oil shocks in the case of Iranian government spending over the period 1959-2007. In addition, the VAR approach is utilized using quarterly data from 1993:Q1-2007:Q3, to analyse the effect of oil price shocks on government spending in Tunisia by Jbir and Zouari-Ghorbel (2009). They find that there is no evidence that oil price shocks affect the economy directly with any effects being seen through the prism of government expenditure.

The findings of the El-Anshasy and Bradley (2012) study on 16 oil exporting countries, using a dynamic Generalized Method of Moments (GMM) model show that oil price increases contribute to lower government spending in the short run but increases it in the long run. However, the results expose that fact that oil price change does not have a noteworthy effect on government spending in both the long and short-run.

2.4.4 Summary of empirical studies effects of oil prices on macroeconomics

A number of empirical studies have evaluated the effect of the positive, negative, asymmetric and no effects of oil prices on economic growth in exporting and importing economies and are illustrated in table 2.1. This shows that the effects of oil price changes on economic growth, inflation, interest rates, exchange rates, unemployment, government spending and income for exporting and importing countries can be both negative and positive. However, there is no evidence of an asymmetric relationship between oil price and fiscal variables in both exporting and importing countries. Also, there is no asymmetric effect of oil price on monetary policy variables in the oil exporting countries. Additionally, there is no effect of oil price on the fiscal element in importing countries.

Table 2.1. Summary of empirical studies effects on oil-macroeconomic nexus

	Oil Price					
	Economic Growth		Monetary Policy		Fiscal Policy	
	Exporting Countries	Importing Countries	Exporting Countries	Importing Countries	Exporting Countries	Importing Countries
Negative	✓	✓	✓	✓	✓	✓
Positive	✓	✓	✓	✓	✓	✓
No Effect	✓	✓	✓	✓	✓	-
Asymmetric	✓	✓	-	✓	-	-

Source 2.4: Author's findings

2.5 The empirical evidence on the effects of oil price volatility on the economy

The literature review conducted an empirical analysis of the effects of oil price volatility on economic growth. In the next part, it examines the research into the relationship between oil price volatility and monetary policy. The last part investigates the effects of oil price volatility on fiscal policy.

2.5.1 The relationship between oil price volatility and economic growth

2.5.1.1 The Negative Effects of Oil Price Volatility

2.5.1.1.1 Oil- Exporting Countries

El-Anshasy et al. (2015) utilizing the standard panel autoregressive distributed lag (ARDL) approach and cross-sectionally augmented version (CS-ARDL), debate the impact of oil revenue and its volatility on real GDP growth. Also, they collect annual and monthly data on a sample of 17 major oil producers in the period 1961- 2013. As a result, there is a substantial negative effect of oil revenue volatility on economic growth.

2.5.1.1.2 Oil- Importing Countries

Ferderer (1997) investigates the relationship between oil price volatility and macroeconomic performance on the US economy during the period 1970:01 to 1990:12. In this study, the oil price volatility is measured by simple standard deviation. Moreover, the result of the vector auto- regressive (VAR) model indicates that volatility increases in response to both oil price increases and decreases. The findings also suggest that the sectoral shocks and uncertainty offer a partial explanation to the asymmetry puzzle. The empirical research demonstrates that oil price volatility has a substantial negative influence on output.

Elder and Serletis (2010) scrutinize the direct effects of oil price uncertainty on the real economy in the United States. The model is based on a structural VAR that is adjusted to accommodate bivariate GARCH-in-mean errors, as in Elder (1995), (2004) and uses quarterly frequency over the period from 1974:2 to 2008:1. The principal result shows that volatility in oil prices has had a negative and significant effect on real GDP, durables consumption, and aggregate output. In addition, it concludes that accounting for oil price uncertainty tends to exacerbate the negative dynamic response of economic performance to a negative oil price shock, and also, dampens the response to positive oil price shocks.

Ng (2012), using time series data from 1983:Q2 to 2009:Q2 under a multivariate co-integrated vector autoregressive (VAR) model creates a realized volatility measure to display the relationship between oil price volatility and the Singapore macroeconomy. This study concludes that the gradual drop of Singapore's oil volume severely signals a weakening relationship between oil price volatility and the macroeconomy.

In Gökçe (2013)’s study, an Exponential GARCH (EGARCH) model is used to find the volatility and structural VAR model to determine the dynamic structural linkage between oil price volatility and economic growth for the Turkish economy using quarterly data for the period 1987:Q1-2011:Q4. The empirical findings indicate that the accumulated reaction of economic growth to a structural shock in real crude oil price volatility is statistically significant with a negative impact in the long-run.

2.5.1.2 The Positive Effects of Oil Price Volatility

*2.5.1.2.1 **Oil- Exporting Countries***

Oriakhi and Osaze (2013) scrutinize the impact of oil price volatility on economic growth in the Nigerian economy using quarterly time series data from 1970 to 2010 and utilizing a VAR model. The findings show that there is a fundamental positive relationship between oil price volatility and economic growth due to the fact that the Nigerian economy is highly vulnerable to oil price changes.

*2.5.1.2.2 **Oil- Importing Countries***

In a vector autoregression (VAR) approach, Rafiq et al. (2009) examine the relationship between oil price volatility and output growth in Thailand. Using quarterly data from 1993:Q1 to 2006:Q4 oil price volatility is measured by using the realized volatility suggested by (Robinson and Torvik). They find that oil price volatility has a statistically significant and positive impact on growth.

Rafiq and Salim (2014) study oil price volatility measured using simple standard deviation for six major emerging Asian economies. Since Indonesia, Malaysia and Thailand were strongly affected by the Asian financial crisis and because the monthly data in this work has spikes during this period, this study implements two different VAR systems, time-series cross-section and time-series analyses for these countries in an attempt to compare the effect channels for the entire period and for the period after the crisis. The oil price volatility for each country is calculated using a non-parametric approach, namely, the realized oil price variance. In order to assess the implementation of such a heterogeneous panel data estimation method a Mean Group (MG), Common Correlated Effects Mean Group (CCEMG) and Augmented Mean Group (AMG) estimators are utilised to allow for cross-sectional dependence. Generally, oil price volatility has a detrimental outcome on these emerging economies. In the short run, oil price volatility influenced positively on output growth in China, India and Indonesia before and after the Asian financial crisis. In Malaysia, oil price volatility impacted on GDP growth, although there is remarkably little evidence of reverse causality. For Thailand, oil price volatility influenced output growth prior to the Asian financial crisis, but the impact disappeared after the crisis. Moreover, oil subsidization by the Thai Government via the introduction of the oil fund played an important role in improving economic performance by reducing the adverse effects of oil price volatility on macroeconomic indicators.

2.5.2 The effects of oil price volatility on inflation, interest rates, exchange rates and unemployment

2.5.2.1 The Negative Effects of Oil Price Volatility

2.5.2.1.1 Oil-Exporting Countries

Selmi et al. (2012) distinguish between the influence of fluctuations in oil prices on the volatility of exchange rates for a small oil-importing economy (Morocco) and a small oil-exporting country (Tunisia). To measure the volatility, a Generalized Autoregressive Conditional Heteroskedasticity GARCH model was employed with quarterly data from 1972:Q2 to 2010:Q4. The results indicate a significant and negative relationship between the real price of oil and the variability of the exchange rate. The effect becomes more volatile post oil and Asian crises.

2.5.2.1.2 Oil- Importing Countries

Ng (2012) estimates a vector autoregression model (VAR) and a vector error correction model (VECM) to look at the affects oil price volatility on key macroeconomics activities for the Singapore economy between 1983:Q2 to 2009:Q2. He found an increasing uncertainty arising from a spike in oil price volatility, which also affected investments adversely.

2.5.2.2 The Positive Effects of Oil Price Volatility

2.5.2.2.1 Oil-Importing Countries

Rafiq et al. (2009) analyse the dynamic effects of oil price volatility on macroeconomics variables in Thailand. The vector autoregression (VAR) method was utilised to analyse quarterly data from 1993:Q1 to 2006:Q4. The empirical results indicate that oil price volatility has an important statistically and positive impact on interest rates, trade balance, unemployment and investment. Furthermore, their estimates suggest that oil price volatility is connected to the budget deficit in the post-crisis period. A floating exchange rate regime was introduced post financial crisis and it is possible that this is a key contributor to the positive relationship between oil price volatility and the budget deficit.

Omojolaibi and Egwaikhide (2014) investigate the effects of changes in oil price volatility on economic activity in the African economies. The panel vector autoregressive (PVAR) model suggests that gross investment reacts more effectively to oil price volatility. However, the response of fiscal deficit, real GDP and money supply are less effective. To summarize, gross investment is the key route via which volatility in oil price influences the real economic sectors of these economies positively. Rafiq and Salim (2014) believe that oil price volatility affected inflation positively in India, Philippines and Indonesia based on research utilizing time-series cross-section and time-series analysis.

2.5.3 The effects of oil price volatility on government spending and income

2.5.3.1 The Negative Effects of Oil Price Volatility

2.5.3.1.1 Oil- Exporting Countries

Chemingui and Hajeeh (2011) extend the research on the impact of oil price volatility on domestic tax and subsidy policies in the Kuwaiti economy. To estimate the fiscal policies for developing countries, they use a computable general equilibrium (CGE) model based on data for the year 2001. The empirical findings show that for a set of scenarios aimed at raising government savings through tax rises or subsidy cuts, the least negative effect on household welfare is when the studies are reduced which is a reflection of efficiency gains attributable to reduced price distortions. The most negative effects follow from increasing government savings through increases in price-distorting import tariffs and the introduction of a non-uniform value-added tax (VAT). Given the small share of non-oil activities in Kuwait’s non-oil gross domestic product (GDP), the introduction of VAT on non-oil activities does not generate a substantial growth in government revenues. In the research of Rutten (2001) he shows oil price volatility adversely affects government budgets and contributes to a deterioration in rural–urban terms of trade, predominantly in exporting primary agricultural commodity countries.

2.5.3.2 The Positive Effects of Oil Price Volatility

2.5.3.2.1 Oil- Exporting Countries

The asymmetric mechanism between the impact of oil price volatility and government spending in Nigerian economy has examined by Oriakhi and Osaze (2013) based on the quarterly data period from 1970 to 2010. Accordingly, the Granger causality tests and VAR model present that oil price volatility evaluated directly positive on real government expenditure.

The both short run and long run impacts of oil price volatility on the fiscal policy of 18 oil-exporting countries (OECs) has analysed applying a vector error correction (VEC) model by Alley (2016). The results demonstrate that oil price volatility decreased proxies by primary fiscal balance (PFB) in the short run. On the other hand, oil price volatility influenced PFB to increase in the long-run, suggesting that OECs' governments eventually consolidate their fiscal positions to decrease short-run fiscal deficit induced by oil price volatility. However, their fiscal policies were pressured in the short run, OECs were able to stabilise their fiscal dynamics in the long-run.

2.5.3.3 The Asymmetric Effect of Oil Price Volatility

2.5.3.3.1 Oil Exporting Countries

Oriakhi and Osaze (2013) survey the asymmetric mechanism relating to the influence of oil price volatility, exchange rate, real imports, real money supply and inflation in the Nigerian economy using quarterly data covering the period from 1970 to 2010. Results from the Granger causality tests and VAR model indicate that the interaction between oil price volatility and macroeconomic variables is significant, with the direction of causality going in at least one direction.

2.5.4 Summary of empirical studies effects of oil price volatility on the economy

A number of empirical works have focussed on the effects of oil price volatility and fiscal variables. Reference to table 2.2 indicate that there is a positive, negative and asymmetric effect on government expenditure in exporting countries; however, there is no such effect amongst importers.

Table 2.2. Summary of empirical studies effects on oil price volatility-macroeconomic nexus

	Oil Price Volatility					
	Economic Growth		Monetary Policy		Fiscal Policy	
	Exporting Countries	Importing Countries	Exporting Countries	Importing Countries	Exporting Countries	Importing Countries
Negative	✓	✓	✓	✓	✓	-
Positive	✓	✓	-	✓	✓	-
No Effect	-	-	-	-	-	-
Asymmetric	-	-	-	-	✓	-

Source 2.5: Author's findings

2.6 Literature review gap

Most of the empirical studies carried out have focused on the oil price, oil price shocks and oil revenues on oil importing economies. Few studies exist yet on the effect of oil price volatility on key macroeconomics variables for oil exporting countries. Additionally, some of the few available studies are country specific.

In other words, there is hardly any literature or empirical findings that examine OPEC and non-OPEC countries from the point of view of both importing and exporting. The thesis, therefore, seeks to contribute to this gap in literature by:

1. Concentrating on oil exporting countries, we examine two groups of countries, namely, OPEC and non-OPEC states with the intention of studying oil volatility between them.
2. There is a limited amount of literature on government expenditure in relation to oil volatility, but this research expands this field of study by including oil volatility and its influence on aggregated and disaggregated government spending.
3. The quality of institutional development is evaluated in the context of oil volatility and government expenditure.

This study intends to fill this gap by focusing on OPEC and non-OPEC countries analysis.

In the light of the debate, the study seeks to enquire the effects of oil price volatility on government spending in OPEC and non-OPEC countries between the period 1983 and 2015.

2.7 Conclusion

In the current economic and geopolitical climate, the effect of oil prices on the global economy cannot be underestimated as many industries and countries across the world are heavily reliant on oil and natural gas. Oil is a strategic commodity in the world as it is the major input in the production process in many industries. The global oil market has experienced different negative and positive shocks over the past four decades. Oil price shocks can be caused by a range of different conditions. The notion that oil shocks can have multidimensional impacts on countries' economies is generally well accepted throughout economic literature, and the debate has centred mainly on the magnitude and the channels of that effect. The impact on oil-importing and oil-exporting countries are significantly different. As noted by Rafiq and Salim (2014) findings from studies that have examined the impact of oil price shocks on macro-economies such as GDP, inflation, and unemployment are varied.

As discussed, different issues of oil price volatility have been addressed by both practitioners and scholars in the economic arena over last four decades. As noted by Ayadi (2005) the relationship between oil price volatility and economic development for oil-importing economies is mixed (e.g. a positive impact for Norway and a negative impact for the United Kingdom), while significantly influencing oil-exporting economies. The effect of increasing oil revenues, money supply, and government expenditure are important factors in evaluating economic performance in oil-exporting economies. During periods of oil price volatility, government spending behaviour and fiscal policies are critical in reducing the harmful effects on economic growth. As noted by Bouchaour and Al-Zeaud (2012), it is important for oil-exporting economies to adopt a policy that allows them to reduce their dependence on oil revenues through diversification of income sources which, in turn, helps reduce inflationary pressures, increases real GDP, and absorbs unemployment in the local economy.

As noted by Rafiq and Salim (2014), there are a large number of studies that examine the impact of oil price shocks on economies but the impact of oil price volatility on economic activities has received surprisingly little attention by researchers. There is limited literature that investigates the impact of oil price volatility in the context of economic activities with very little evidence to identify oil price volatility impact in developing nations. The author of this thesis attempts to fill this research gap in the oil price–output literature. This study, for the first time, analyses the impact of oil price volatility on government spending in OPEC and non-OPEC economies. Furthermore, to the best of the author's knowledge, this study will be one of the first studies that analyses the impact of oil price volatility on government spending behaviour in oil-exporting economies.

The aim of this doctoral research study is to empirically examine the dynamic relationship between oil price volatility and government spending behaviour in OPEC and non-OPEC countries. Along with oil price volatilities accrue directly to the government, the oil prices fluctuations explain into higher government spending. Oil markets have seen almost unprecedented volatility in the last years, this uncertainty in crude oil prices have influenced general expenditures within national economies. In this thesis, the writer attempts to fill this gap and answer how and to what extent oil price volatility impacts on aggregated and disaggregated government spending behaviour in oil-exporting economies. In particular, the oil price volatility effects on governments' current expenditure in the economies of OPEC and non-OPEC countries will be assessed in more detail.

Chapter 3- Methodology

3.1 Introduction

Research methodology is principally concerned with those decisions and actions that are taken with regard to the research aims and research questions within a structure of specific determinants to express the problem to be examined and to choose appropriate methods for data collection, data analysis and reporting the findings. In the case of this study, which adopts a deductive, positivist research approach, it is important that every characteristic of the research should be clearly identified to enable other researchers who follow the same strategy, methodology and method to attain the same outcomes.

This chapter discusses the research philosophy, research design, research methodology and methods that will be used in the research and explains how these elements contribute to systematic research in order to establish facts and reach conclusions, hence, a well-defined methodology is essential if reliable results are to be obtained. This chapter also describes the methodology chosen to conduct the research, justifies the decision made and illuminates the rationale as to why such methodology was judged to be appropriate for this research and the associated statistical tests used in the thesis which are explained and developed throughout the study.

3.2 Research design

The importance of research design derives from its role as a critical link connecting the theories and arguments that underpin the research and the experimental data collected (Nachmias and Nachmias 2008). Research is meaningless and lacks substance without appropriate design to validate its outcomes (Javadi 2013). Hussey and Hussey (1997, P.54) and Churchill Jr (1979) state the research design as the overall approach to the research process, from the theoretical perception to the collection and analysis of the data. Planning and the subsequent accomplishment of the research are thus critical constituents of research design.

Saunders et al. (1997, P. 72) and Javadi (2013) clarify the advantages of research design as follows:

- It supports the researcher to attain a general configuration of the research process to certify success.

- Researcher creates an informed decision about the research approach
- It is beneficial to adopt the research design to provide for restrictions
- For specific research, it helps the researcher to define appropriate research approaches (appropriate research approaches should support and explain the why's, how's and what's of the subject).

According to Oppenheim (1999) research design refers to the plan or strategy of the research, and the logic behind it, which will make it possible and valid to draw more common conclusion from it. Agreeing with Oppenheim (1999) and Miller and Wilson (1983) characterize research design as the general plan of the research that is intended to yield answers to research questions. Balnaves and Caputi (2001) indicate that research design is the guide to how the research is created and carried out. Therefore, the research design can be categorised according to five major forms: descriptive, comparative, analytical, exploratory and predictive Pizam (1994), Finn et al. (2000), Balnaves and Caputi (2001), Jennings (2001), Collis and Hussey (2013) and Spiers (2018).
This study is concerned with oil volatility and how it contributes to government spending in oil exporting countries, an area in which relatively few studies have been conducted, and consequently the researcher seeks to analyse, and then understand the phenomena. Hence this work falls within the ambit of analytical research.

3.3 Research philosophy

According to Howell (2013) and Spiers (2018), "Research involves understanding the relationship between theory, philosophy (ontology and epistemology), methodology and methods" (Howell 2013).

A research philosophy comprises a series of beliefs and understandings concerning the collection, interpretation, and analysis of data collected (Levin 2008; Bryman 2016). It refers also to the development of knowledge in a specific field. The assumptions made as a consequence of the researcher's personal ontology, epistemology and axiology provide the philosophy basis for how the research will be conducted (Simpson 2009; Flick 2013). The different philosophical approaches described in the research onion are broadly consistent with the core assumptions of social science that Burrell and Morgan (1979) have recognised (Saunders et al. 2012).

Ontology: Ontology denotes a particular world view as to the nature of phenomena under intense examination or study (Javadi 2013). Ontology is stated by Crotty (1998, p10) as: "the study of being. It is concerned with 'what is', with the nature of existence, with the structure of reality as such". Johnson et al. (2004, p.11) define ontology as "the investigation of what is ultimately real. They argue that ontology and epistemology, how we know what we know, sit alongside each other but do not merge.

In philosophy, there are two opposing alternatives of seeing the world: 1) the natural world exists regardless of whether we, as human beings, are conscious of it; and 2) the social world exists, albeit in various guises, for instance institutions, networks, tribes or nations (Easterby-Smith 1997; Javadi 2013; Vakalfotis 2016).

Epistemology: The second assumption is epistemology; it is inter-connected with the first assumption. A description of epistemology has been expressed by Johnson et al. (2004, p.13) as "the branch of philosophy that addresses questions concerning the nature, scope, and sources of knowledge, belief, and rationality. With a different emphasis, Klein (2005) describes epistemology as,

> "one of the core areas of philosophy… concerned with the nature, sources and limits of knowledge…. primarily concerned with propositional knowledge, that is, knowledge that such-and-such is true, rather than other forms of knowledge, for example, knowledge of how to such-and-such" Klein (1998, p1).

This knowledge would establish how one can define truth or falsehoods. It depends totally on the nature of knowledge itself as bring "hard" or "real" and able to be attained or "soft" that is based on the uniqueness of individuals' experiences and his or her perceptions and interpretations of the world. The term epistemology (what is known to be true) as contrasting to doxology (what is believed to be true) encompasses the different philosophies of research approach (Holden and Lynch 2004; Javadi 2013; Vakalfotis 2016; Collins 2017; Hetherington 2018).

Axiology: Axiology is the third element of research philosophy. It is concerned with the role of researcher's values in the process of discovery. The mind set and opinion of the researcher plays a crucial role in affecting the entire process of research. An individual's values, hopes, expectations, and feelings the positivist, objectivist researcher would argue, have no place in scientific inquiry. The data collection, sampling, selection of topic and other research methodologies could be affected by the personal values of the researcher and ultimately influence the results of the study. Thus, these are the outside elements of research onion model (Bahm 1993; Mingers 2004; Durant-Law 2005).

Research philosophy has resultant perspectives such as positivism, realism, interpretivism, and pragmatism that influence the way in which the researcher thinks about the research process (Galliers and Sutherland 1991).

Positivism: Positivism, first expressed as a construct by Comte, is associated with experiments and quantitative research. Positivism is a form of or a progression of empiricism (Hjørland and Nissen Pedersen 2005) and is closely linked to the scientific method and objectivism. Phillips and Burbules (2000) suggest that empiricism is one of two forms of the foundation of positivist philosophy – rationalist or empiricist – which believes knowledge should be objective and free from any bias stemming from the researcher's values and beliefs. Therefore, the researcher is responsible for determining the gap among the actual knowledge and the accepted knowledge. The researcher develops the research questions from a hypothesis and can test the hypothesis in the actual and natural environment. It describes the general truth that could never be changed under any circumstances. The positivist research philosophy deals with what is claimed by many to be the top-most layer of truth and reality by testing the hypothesis in the real world and as such the role of statistical analysis is prevalent in positivism research philosophy (Weber 2004; Bryman 2016; Hetherington 2018).

Realism: Whereas the positivist researcher is often thought of as the scientist, the critical realist may be considered as the archaeologist who uses scientific techniques to, for example carbon-date artefacts but also seeks to interpret the meaning and application of such items. There is thus a difference between realism and positive research philosophy. Both the philosophies work, in the same way, and their values are based on same ideology. The social reality never changes as per the change in the circumstances, and it always remains the same as proposed by realism research philosophy. The only difference in the realism and positivism is that the scientific approaches and certain universally accepted truths and realities could be changed or tested under controlled environment. The realist research philosophy comes into existence when there is narrow, but the possible scope is available to test the already established fact or reality. The scientific approaches are not perfect, and scope of continuous development is always available. The theories could be reviewed, and most notably the researcher can concentrate on the application of new research methods, and experimental method could come into existence (Guba and Lincoln 1994; Borg et al. 2002; Jacobsen 2005; Howell 2013)

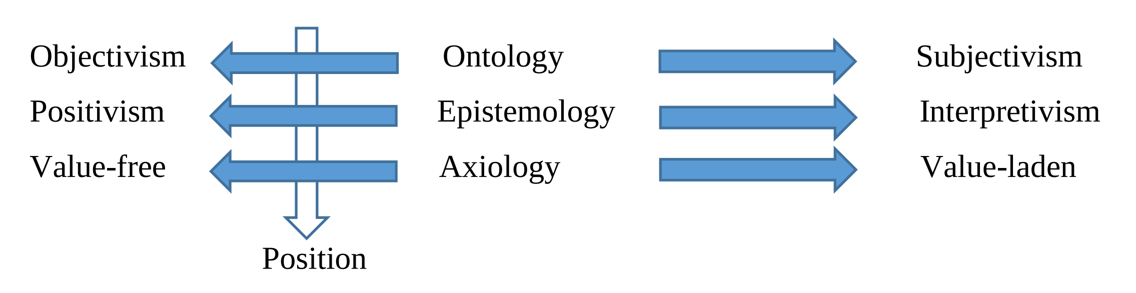
Interpretivism: Interpretivism proposes that truth and knowledge are subjective, as well as culturally and historically sited, and based on people's unique experiences and their understanding of them. Researchers accept can never be entirely separate from their own values and beliefs, and that there can never be observations without observers. Furthermore, the researcher tends to examine all the aspects and focus on classifying the meaningful change within the society. Therefore, these will inevitably notify the way in which they collect, interpret and investigate data (Costelloe 2003; Bryman 2016; Hetherington 2018).

Similar to positivism, interpretivism has its historical roots in anthropology. However, it is in opposition to positivism, so is sometimes known as anti-positivism (Flick 2013). Interpretivism argues that truth and knowledge are subjective, as well as culturally and historically situated, based on people's experiences and their understanding of them (Spencer et al. 2003; Hetherington 2018)

Pragmatism: According to Simpson (2009) pragmatism looks to account for lived experience and is part of the history of social science and shows the existence of both the constructivist and objectivist approach. Also, pragmatism claims that the most important determinant of the epistemology, ontology and axiology adopted in a research is the research question. This provides that the research questions and objectives are the most key aspects in research philosophy; one may be more proper than the other for answering specific questions. Hence, it can be discussed that mixed approaches, both qualitative and quantitative, are possible, and possibly highly appropriate, within one study (Saunders et al. 2012). As a result, Creswell (2009) claims that instead of concentrating on approaches, researchers should highlight the research problem and apply all methods available to understand the problem. Harter (2007) however, suggests that pragmatism is concerned more with definite relations between things and phenomena, specifically among antecedents and consequences. Thus, pragmatism suggests an appropriate structure within which to understand leadership (Harter 2007).

Building upon the previous paragraphs, Figure 3.1 shows a representation of the positioning of the researcher related to this study within the philosophical continuum, see Figure 3.1.

Figure 3.1. Philosophical positions and paradigms



Source: Spiers (2018)

This study adopts positivism as a research philosophy as some contributions are regarded as acceptable knowledge of the reality (Bell and Bryman 2007). Positivism assumes that reality exists independently of the thing being studied. In practice this means that the meaning of phenomena is consistent between subjects (Newman and Benz 1998). The positive approach is commonly used in social sciences such as economy and finance. In this research, the positive approach is appropriate as the objective is to clarify the causality and regularity of variables. Typically, the positive approach is related to research hypotheses. This research derives its hypotheses from key theories and previous literature on oil and macroeconomics.

3.4 Research approach

Research approach is the second layer of Saunders et al.'s research onion (Saunders et al. 2012). There are three kinds of research approaches namely deductive, inductive and abductive. The deductive approach focuses on using the literature to develop theories and hypotheses that the researcher will analyse applying data. However, the inductive approach consists of collecting data and developing a theory as the outcomes of data analysis (Saunders et al. 2012). The abductive approach is to be seen as different from a mixture of deductive and inductive approaches. An abductive approach is fruitful if the researcher's objective is to discover new things — other variables and other relationships (Dubois and Gadde 2002). In practice however, most qualitative research are abductive in approach, combining elements of both the inductive and deductive approach (Suddaby 2006).

The deductive approach is chosen in this research. This thesis departs from theories (deductive approach). Following Robson (2002), this empirical study uses five stages of deductive progress. First, the hypotheses are assumed from theories associated to the oil and macroeconomics determination field. Second, the hypotheses are expressed in operational terms. Third, the hypotheses are tested. Fourth, the specific outcome of the hypotheses is examined. Finally, the underlying theoretical method is adjusted or revised (Calderon-Morales, 2015).

3.5 Research method

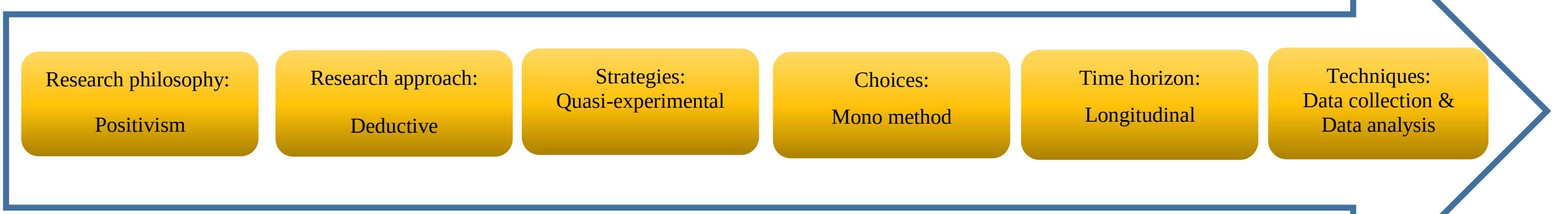
The quantitative method typically refer to factors such as sample size, types of data to be collected, sampling and recruitment methods, data collection processes, data management and analysis strategies. Robson (2002) explains that quantitative research is relevant when the relationship between variables is signified. Cooper et al. (2006) also show that this method should not impact the research finding since the contributor responses are coded, categorized and dropped to numbers that are manipulated for statistical analysis. Depending upon the sample size and the quality of the raw data it has been noted that reliability is high in survey research (Babbie 2004).

In contrast, qualitative research may not rely on large data sets is my focus upon small groups or individuals. The researcher may be intimately involved with the research subject in such as Action Research. Thus, this particular methodology and its elements involve close involvement by the researcher (Cloke et al. 1991; Hume 1993; Howell 2013; Duncan 2017). Olds et al. (2005) indicate that qualitative research is applied to collect and analyse textual and other data through such as surveys, interviews, focus groups, conversational analysis, and observation. Similarly, Creswell (2003) suggests that a qualitative technique is employed to examine an issue associated to the work of interviewees by obtaining their insights, attitudes and perceptions. As a result, a qualitative method may be applied to achieve detailed justification from George interviewees based on their experience of how to improve, for example, the effect of transformational leadership behaviours on development of organizational commitment and ultimately improve employees work performance.

Many researchers have distinguished qualitative research from quantitative research on the basis of their nature and features (see Berg 2003; Newman 1998; Creswell 2003; Papamichael 2007; Javadi 2013).

In line with the positivism and the deductive approach (Bell and Bryman 2007), the quantitative method is selected in this empirical study, see Figure 3.2. Given the research dataset, the quantitative approach is the best method to accomplish the research objective. The quantitative method is applied in this study to examine the relationship between oil and macroeconomics variables and also compare the outcomes with other literature contributions (Calderon-Morales 2015).

Figure 3.2. Stages of this empirical research



Source: Author

3.6 Panel VAR approach

The VAR techniques have been employed mostly to analyse macroeconomic time series data. In addition, over the past two decades, significant developments have been made in the study of dynamic PVAR models (Binder et al. 2005). Therefore, the PVAR is quite a common technique in contemporary econometric analysis. The PVAR methodology, originally developed by Holtz-Eakin et al. (1988), combines the traditional VAR approach introduced by Sims (1980), which treats all the variables in the system as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity.

According to Antonakakis et al. (2017) and Sigmund and Ferstl (2019) the popularity of the PVAR model in empirical economics (and other social sciences) is documented by over 1000 citations of Holtz-Eakin et al. (1998) paper. Panel VARs have been employed to address a variety of issues of interest to applied macroeconomists and policymakers, such as, business cycle convergence and cross sectional dynamics (Canova and Ciccarelli 2012; Canova et al. 2007), the construction of coincident or leading indicators of economic activity (Canova and Ciccarelli 2009), financial development and dynamic investment behaviour (Love and Zicchino 2006), housing price dynamics (Head et al. 2014) and exchange rate volatility dynamics (Grossmann et al. 2014), among others.

To the best of our knowledge, this type of study has not been done till date and we are the first to apply PVAR method for this kind of research. The advantages of the PVAR technique are threefold. Firstly, it defines a flexible structure that combines the traditional VAR approach with panel data and boots the efficiency and the potency of analysis which treats all the variables in the system as endogenous and permits for unobserved singular heterogeneity (Love and Zicchino 2006; Mishkin and Schmidt-Hebbel 2007). Secondly, the approach can take into account intricate relations and ascertains dynamic responses of variables following exogenous shocks using both impulse response functions and variance decompositions. Therefore, it illustrates a systematic method of capturing the strong dynamic frameworks among various variables over time. This allows perfect inspection of the economy's response to oil price volatilities. Thirdly, it addresses the endogeneity problem by allowing for endogenous relations and feedback impacts amongst variables in the structure (Tiwari 2011; Omojolaibi and Egwaikhide 2014).

We extend Holtz-Eakin et al. (1988) model to allow for ρ lags of m endogenous variables, k predeterminded variables. Therefore, we consider the following stationary PVAR model with fixed effects[1].

$$Y_{it} = \sum_{j=1}^{p} A_j \; Y_{it-j} + \mu_i + \lambda_t + \varepsilon_{it} \tag{3.1}$$

Let $Y_{it} \epsilon R^m$ be an $1 \times m$ vector of endogenous variables at time t and for country i. Let $Y_{it-1} \epsilon R^m$ be an $1 \times m$ vector of lagged endogenous variables. Moreover, the disturbances ε_{it} are error term for all i and t. We assume that the innovations have the following characteristics: $\boldsymbol{E}[\boldsymbol{\varepsilon_{it}}] = \boldsymbol{0}, \boldsymbol{E}[\boldsymbol{\varepsilon'_{it}\varepsilon_{it}}] = \boldsymbol{\Sigma}$ and $\boldsymbol{E}[\boldsymbol{\varepsilon'_{it}\varepsilon_{is}}] = \boldsymbol{0}$. The (mxm) matrices $\boldsymbol{A_0}, \boldsymbol{A_1}, \dots, \boldsymbol{A_{j-1}}, \boldsymbol{A_j}$ is parameters to be estimated.

More specifically, in our case, Y_{it} is a 1×5 vector of our key dependent/endogenous variables, namely, oil volatility proxies (OilV, OilrevenueV and OilrentV), real GDP per capita (in 2010 US$) (R_GDP), nominal exchange rate (LCU)[2] per US$ (R_EXCH), inflation consumer prices (INF) and general government spending and also the sub-categories of government spending comprises of education spending, military spending, and health spending (SPEND). The autoregressive structure allows all endogenous variables to enter the model with a number of j lags. The optimal lag-length is determined by the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). μ_i accounts for the unobservable country characteristics (country fixed-effects), λ_t accounts for any global shocks that may affect all countries in the same way (time fixed-

[1] A random effects specification in a dynamic panel context is possible but requires strong assumption on the individual effects. Empirical applications mostly use a fixed-effects specification. We do not consider a random-effects implementation at this stage. See Binder et al. (2005) for more details.
[2] Local Currency Units

effects). For example, time fixed effects capture common factors such as key global risk factors. To deal with the time fixed effects we time difference all the variables prior to inclusion in the model, which is equivalent to putting time dummies in the system. Finally, ε_{it} denotes the error term.

Over the past decades important advances have been made in the study of dynamic panel data models with fixed effects for the typical setting that cross-sectional dimension (N) is large and the time dimension (T) is short. Classical OLS-based regression methods cannot be applied because of the Nickell bias (Nickell, 1981) that does not disappear asymptotically if N → ∞ and T is fixed. One solution to this problem is to apply generalized method of moments estimators popularized by Hansen (1982) in economics. Important contributions are Anderson and Hsiao (1982), Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell, Bond (1998), and Abrigo and Love (2016).

Therefore, we elected to use the Abrigo and Love (2016) method, which uses GMM estimators with fixed effects promulgated by Arellando and Bover (1995). Also, Juessen and Linnemann (2010) examine the properties of different types of PVAR estimators from macroeconomic (large T) data (assuming N = 20). Their results show that when the degree of variability of the cross-sectional in the time series of the data is small, the proposed estimators of Arellando and Bover (1995) have the least bias compared to other estimators. However, the standard deviation is slightly larger than the least squares dummy variable (LSDV) method. Since the degree of variability of the cross-sectional increases in the time series of the data, the GMM estimator bias toward LSDVC increases but with the $T \leq 10$ and $N = 20$ the GMM estimator bias is lower than the other methods. However, the results of the impulse response functions obtained from the GMM estimates of Arellano and Bover (1995) are more consistent with the simulated values than the other estimates.

In order to get a more complete picture of the dynamic interactions among oil volatility, government spending, inflation rate, exchange rate and economic growth, education spending, military spending and health spending, we perform a panel generalised impulse-response function (PGIRF) analysis, in order to assess the speed of adjustments to shocks originating in our aforementioned variables. The panel generalised impulse response function analysis employed, which is based on Koop et al. (1996) and Pesaran and Shin (1998), provides a natural solution when theory does not provide a clear cut guidance on the ordering of the aforementioned endogenous variables, as discussed above.

In this research, we apply a panel Vector Auto-Regressive (PVAR) approach along with panel impulse response functions from the period 1983 to 2015. Also, we use Generalized impulse response function because the order of the variables is not important and is not dependent on any assumptions relating to the ordering of the variables. However, for example, the Cholesky-decomposition or the Orthogonal impulse response are dependent on the ordering of variables (Sigmund and Ferstl 2019; Abrigo and Love 2016).

Moreover, the PGIRFs are also decomposed into the responses of shocks to specific variables by taking out from the PGIRFs the effects of shocks to all other variables Koop et al. (1996), which gives us further insights into the transmission mechanisms at work (Antonakakis et al. 2017a; Antonakakis et al. 2017b; Antonakakis et al. 2017c).

According to Sigmund and Ferstl (2019) instead of providing a shock to all the elements of ε_{it} Pesaran and Shin (1998) choose to shock only one element, say its r-th element and integrate out the effects of other shocks using the historically observed distribution of the errors. In this case, we have

$$GIRF\ (k, r, \Sigma_{\in}) = \ E[Y_{it+k}|\varepsilon_{itr} = \ \delta_r, \Sigma_{\in}\ ] - \ E[Y_{it+k}|\Sigma_{\in}\ ] \tag{3.2}$$

Where k is the number of periods after the shock to the r-th component of ε_{it} and $\Sigma_{\in}$ to be the covariance matrix of ε_{it}.

By setting $\delta_r = \ \sqrt{\Sigma_{\in,,r,r}}$ we obtain the generalized impulse response function by

$$GIRF\ (k, r, \Sigma_{\in}) = A^k\ \Sigma_{\in}\ (\sigma_{r,r})^{-1/2} \tag{3.3}$$

where $\sigma_{r,r}$ is the r-th diagonal element of $\Sigma_{\in}$. In this specification we assume parameter homogeneity for $A\ (m \times m)$ for all $i\ and\ k$ is the number of periods after the shock to the r-th component of ε_{it}.

GIRF is unaffected by the ordering of variables. The GIRF of the effect of an unit shock to the r-th equation is the same as that of an orthogonal impulse response but different for other shocks. Hence, the GIRF can easily computed by using OIRF with each variable as the leading one.

Consider the following VAR (1) model in the two variables $y_{1t}\ , y_{2t}$:

$$\begin{pmatrix} OilVD_{1t} \\ SPEND_{2t} \end{pmatrix} = \begin{pmatrix} \varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22} \end{pmatrix} \begin{pmatrix} OilVD_{1,t-1} \\ SPEND_{2,t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} \quad (3.4)$$

The linear correlation between u_{1t} and u_{2t} can be characterized by $u_{1t} = (\frac{\sigma_{12}}{\sigma_{22}})\, u_{2t} + \eta_{1t}$,

Where $\sigma_{12} = var(u_{1t}, u_{2t}), \sigma_{22} = var(u_{2t})$, and the new error, η_{1t} has a zero correlation with u_{2t}. Using this relationship we have

$$\begin{aligned} OilVD_{1t} = \varphi_{11} OilDV_{1,t-1} + \varphi_{12} SPEND_{2,t-1} \\ + \left(\frac{\sigma_{12}}{\sigma_{22}}\right)\big(SPEND_{2t} - \varphi_{21} OilVD_{1,t-1} \\ - \varphi_{22} SPEND_{2,t-1}\big) + \eta_{1t}, \end{aligned} \quad (3.5)$$

Or

$$OilVD_{1t} = \left(\frac{\sigma_{12}}{\sigma_{22}}\right) SPEND_{2\,t} + (\varphi_{11} - \frac{\sigma_{12}}{\sigma_{22}}\varphi_{21}) OilDV_{1,t-1} + (\varphi_{12} - \frac{\sigma_{12}}{\sigma_{22}}\varphi_{22}) SPEND_{2,t-1} + \eta_{1t}$$

n This formulation $OilVD_{1t}$ is contemporaneously related to $SPEND_{2\,t}$ if $\sigma_{12} \neq 0$. Therefore, in general a "unit" change in u_{2t}, through changing $SPEND_{2\,t}$, will have a contemporaneous impact on $OilVD_{1t}$ and, vice versa, a unit change in u_{1t} will have a contemporaneous impact on $SPEND_{2\,t}$.

Under orthogonalized impulse response analysis the system is constrained such that the contemporaneous value of $OilVD_{1t}$ does not have a contemporaneous effect on $SPEND_{2\,t}$. But the contemporaneous value of $SPEND_{2\,t}$ does affect both $OilVD_{1t}$ *and* $SPEND_{2\,t}$. Namely, a recursive structure is assumed for the contemporaneous relationship between $OilVD_{1t}$ and $SPEND_{2\,t}$. In the present example this is achieved by combining (3.13) with the second equation in the VAR, namely,

By construction η_{1t} and u_{2t} are orthogonal. Hence shocking η_{1t} will move $OilVD_{1t}$ on impact but leaves $SPEND_{2\,t}$ unchanged. By contrast, a shock to u_{2t} of size, say $\sqrt{\sigma_{22}}$, will move $SPEND_{2\,t}$ directly by the amount of the shock, $\sqrt{\sigma_{22}}$, and through equation (3.5) will cause $OilVD_{1t}$ to move on impact by the amount of $\left(\frac{\sigma_{12}}{\sigma_{22}}\right)\sqrt{\sigma_{22}} = \frac{\sigma_{12}}{\sqrt{\sigma_{22}}}$.

3.7 Panel unit root tests

Most of the econometric models used in the early decades were based on the assumption of stationary time series. However, latterly these have been rejected, with the use of variables becoming dependent on performing stationary tests. Additionally, concern about the existence of random trends and spurious regressions created by a vector of variables, led to the use of unit root tests before performing the estimation. For this reason, in this section we discuss the stationary variables and their tests in panel data. Th panel unit root test was promulgated by Breitung and Meye (1994) and Quah (1994). In order to estimate the PVAR model, we will first determine whether the variables are integrated in the same order. For this purpose, this study employs panel unit root tests developed by Levin et al. (1992) (hereafter LLC), and Im et al. (1997) (hereafter IPS).

Levin and Lin (1992) examine the stationarity of the panel data simultaneously for the time series under study across the cross sections. Im et al. (1997) first examine the stationarity of panel data over the desired time interval between the different cross sections and then they estimate the test statistics for each cross section separately. They then used the mean test statistic as the final test. Fisher (1932) used the unit root test in the time interval between cross sections in order to achieve the stationarity of panel data at the significant level. Pesaran (2007) suggests the Dickey-Fuller cross-section test for cases in which panel data correlated with cross-sections.

3.7.1 First generation Panel unit root test

3.7.1.1 The Levin- Lin (LL) Test

Levin and Lin (1992) conduct an exhaustive study and develop unit root tests for the model:

$$\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \alpha_0 + \delta t + \alpha_i + \theta_t + \varepsilon_{i,t}\,, \tag{3.6}$$

$$i = 1,2,\ldots,N, t = 1,2,\ldots,T.$$

Where N is the number of cross-sections, T is the time period, ρ is self-correlated parameter for each cross-section, δ shows the time fixed-effects, θ_t represents the fixed coefficient for each cross-section, $\varepsilon_{i,t}$ denotes the error term and it has normal distribution.

Therefore, the model incorporates a time trend as well as individual and time specific effects. Initially, they assume that $\varepsilon_{i,t} \sim IID(0, \sigma^2)$ but they state that under serial correlation, with the inclusion of lagged first differences as in the ADF test, the test statistics have the same limiting distributions, provided the number of lagged differences increases with sample size. Levin and Lin consider several subcases of this model. In all cases the limiting distributions are as $N \rightarrow \infty$ and $T \rightarrow \infty$.

Also, in all cases, the equation is estimated by OLS as a pooled regression model. The sub models are:

Model 1: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \varepsilon_{i,t}$ $\quad H_0: \rho = 0$

Model 2: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \alpha_0 + \varepsilon_{i,t}$ $\quad H_0: \rho = 0$

Model 3: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \alpha_0 + \delta t + \varepsilon_{i,t}$ $\quad H_0: \rho = 0, \delta = 0$

Model 4: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \theta_t + \varepsilon_{i,t}$ $\quad H_0: \rho = 0$

Model 5: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \alpha_i + \varepsilon_{i,t}$ $\quad H_0: \rho = 0, \alpha_i = 0 \; for \; all \; i$

Model 6: $\Delta_{y_{i,t-1}} = \rho y_{i,t-1} + \alpha_i + \delta_i t + \varepsilon_{i,t}$ $\quad H_0: \rho = 0, \delta_i = 0 \; for \; all \; i$

For models 1-4, they show that

(a) $T\sqrt{N}\,\hat{\rho} \Rightarrow N(0,2)$

(b) $t_{\rho=0} \Rightarrow N(0,1)$

For model 5, if $\sqrt{N}/T \rightarrow 0$, then

(a) $T\sqrt{N}\,\hat{\rho} + 3\sqrt{N} \Rightarrow N(0,10.2)$

(b) $\sqrt{1.25}t_{\rho=0} + \sqrt{1.875N} \Rightarrow N(0,645/112)$

In model 6, both intercept and time trend vary with individuals. In the empirical applications, Oh (1996) employs only models 1 and 5. Wu (1996) applies the complete set of models with trend, and individual and time-specific effects but uses the distributions derived for model 5. Papell (1997) uses model 5 with lagged first differences, however, computes his own exact finite sample critical values using Monte Carlo methods and finds them 3 to 15 percent higher than those tabulated in Levin and Lin (1992).

Levin and Lin claim that in contrast to the standard distributions of unit root test statistics for a single time series, the panel test statistics have limiting normal distributions. However, the convergence rates are faster as $T \rightarrow \infty$ (super consistency) than as $N \rightarrow \infty$.

Moreover, Levin and Lin (1993) find that panel unit root tests are considered to take care of the problem of heteroscedasticity and autocorrelation. They involve the following steps. (i) Subtract cross-section averages from the data to eliminate the influence of aggregate effects. (ii) Apply the augmented Dickey-Fuller (ADF) test to each individual series and normalize the disturbances. For illustration, we use model 5. The ADF regression:

$$\Delta_{y_{i,t}} = \rho_i y_{i,t-1} + \sum_{j=1}^{\rho_i} \theta_{ij}\, \Delta_{y_{i,t-j}} + \alpha_i + \varepsilon_{i,t} \tag{3.7}$$

is equivalent to performing two auxiliary regressions of $\Delta_{y_{i,t}}$ and $y_{i,t-1}$ on the remaining variables in equation (3.3). Let the residuals from these two auxiliary regressions be $\hat{e}_{i,t}$ and $\hat{V}_{i,t-1}$ respectively. Now regress $\hat{e}_{i,t}$ on $\hat{V}_{i,t-1}$:

$$\hat{e}_{i,t} = \rho_i \hat{V}_{i,t-1} + \varepsilon_{i,t} \tag{3.8}$$

To get $\hat{\rho}_i$, directly, which is equivalent to the OLS estimator of ρ_i in (3.3) and since there is s heteroscedasticity in $\varepsilon_{i,t}$, they suggest the following normalization to control it:

$$\hat{\sigma}_{e_i}^2 = \frac{1}{T - p_i - 1} \sum_{t=p_i+2}^{T} (\hat{e}_{i,t} - \hat{\rho}_i \hat{V}_{i,t-1})^2 \tag{3.9}$$

$$\tilde{e}_{i,t} = \frac{\hat{e}_{i,t}}{\hat{\sigma}_{e_i}}$$

$$\tilde{V}_{i,t-1} = \frac{\hat{V}_{i,t-1}}{\hat{\sigma}_{e_i}}$$

Asymptotically, $\tilde{e}_{i,t}$ will be i.i.d. for all individual i.

(iii) Estimate the ratio of long-run to short-run standard deviation for each individual series and then calculate the average ratio for the panel as:

$$\hat{S}_{NT} = \frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\sigma}_{y_i}}{\hat{\sigma}_{e_i}} \tag{3.10}$$

where the long-run variance $\hat{\sigma}_{y_i}^2$ is estimated by

$\hat{\sigma}_{y_i}^2 = \frac{1}{T-1} \sum_{t=2}^{T} \Delta y_{i,t}^2 + 2 \sum_{L=1}^{\bar{K}} w_{\bar{K}\,L} \left(\frac{1}{T-1} \sum_{t=L+2}^{T} \Delta_{y_{i,t}} \Delta_{y_{i,t-L}}\right)$, $\bar{K}$ is the lag truncation parameter and $w_{\bar{K}\,L}$ is some lag window.

(iv) Compute the panel test statistic. Then consider the following regression:

$$\tilde{e}_{i,t} = \rho \tilde{V}_{i,t-1} + \tilde{\varepsilon}_{i,t} \tag{3.11}$$

Using all i and t. The resulting t-statistic is

$$t_{\rho=0} = \frac{\hat{\rho}}{RSE(\hat{\rho})} \tag{3.12}$$

Where $RSE(\hat{\rho}) = \hat{\sigma}_{\varepsilon}\left[\sum_{i=1}^{N}\sum_{t=2+p_i}^{T}\hat{V}_{i,t-1}^{2}\right]^{-1/2}$

$\hat{\sigma}_{\varepsilon}^{2} = \frac{1}{N\tilde{T}}\sum_{i=1}^{N}\sum_{t=2+p_i}^{T}(\tilde{e}_{i,t} - \hat{\rho}\,\tilde{V}_{i,t-1})^{2}$

$\tilde{T} = T - p - 1$ and $\bar{p} = \frac{1}{N}\sum_{i=1}^{N}p_i$

is the average lag length used in the individual ADF regression. Since the test statistic is not centered at zero, Levin and Lin suggest using the following adjusted t-statistic:

$H_0: \rho = 0, t_{\rho}^{*} \Rightarrow N(0,1)$

In the simulations reported later we employed this procedure. The major limitation of the Levin- Lin tests is that ρ is the same for all observations. Hence, if we denote by ρ_i the value for the ith cross-section unit then Levin- Lin test specifies the null H_0 and alternative H_1 as:

$H_0 = \rho_1 = \rho_2 = \ldots. = \rho_N = \rho = 0$

$H_1 = \rho_1 = \rho_2 = \ldots. = \rho_N = \rho < 0$

The null makes sense under some circumstances, but the alternative is too strong to be held in any interesting empirical cases. For example, in testing the convergence hypothesis in growth models, one can formulate the null as implying that none of the economies under study converges and thus $\rho = 0$for all countries. But it does not make sense to assume that all the countries will converge at the same rate.

3.7.1.2 The Im-Pesaran-Shin (IPS) Test

The above tests are restrictive because they assume that ρ is the same across all countries, including under the alternative hypothesis. The heterogenous alternative hypothesis H_1 is used by Im et al. (2003). Their test is based on averaging the augmented Dicky-Fuller (ADF) test statistics over the cross-sectional units, while allowing for different orders of serial correlation. They also propose a test based on the N Lagrange multiplier statistics for $\rho = 0$, averaged over all countries. The idea underlying these tests is quite simple: if you have N independent test statistics their average will be asymptotically normally distributed, for $N \rightarrow \infty$. Consequently, the tests are based on the comparison of appropriately scaled cross-sectional average test statistics with critical values from a standard normal distribution.

Therefore, the assumption of this test is as follow:

$$H_0: \rho_i = 0; i = 1,2, \dots, N$$

$$H_1: \begin{cases} \rho_i = 0\ ;\ i = N_1 + 1, \dots, N\ ; & 0 < N_1 < N \\ \rho_i < 0\ ; & i = 1,2, \dots, N_1 \end{cases}$$

Take model 5 in Levin and Lin and substitute ρ_i for ρ. Essentially what we have is a model with a linear trend for each of the N cross-section units. Thus, instead of pooling the data, we use separate unit root tests for the N cross-section units. Consider the t-test for each cross-section unit based on T observations. Let $t_{i,T}$ $(i = 1,2, \dots, N)$ denote the t-statistics for testing unit roots and let $E(t_{i,T}) = \mu$ and $V(t_{i,T}) = \sigma^2$. Then

$$\sqrt{N}\frac{(\bar{t}_{N,T} - \mu)}{\sigma} \Rightarrow N(0,1), \tag{3.13}$$

where $\bar{t}_{N,T} = \frac{1}{N}\sum_{i=1}^{N} t_{i,T}$

The problem is computing μ and σ^2. This is measured by Monte Carlo methods. Although the important thing to note is that the IPS test is a way of combining the evidence of the unit root hypothesis from the N unit root tests performed on the N cross-section units. Note that implicit in the test is the assumption that T is the same for all cross-section units and hence $E(t_{i,T})$ and $V(t_{i,T})$ are the same for all i. Thus, we are considering only balanced panel data. In practice, if unbalanced data are used, more simulations have to be carried out to get critical values. In the case of serial correlation, IPS propose using the ADF t-test for individual series. However, $E(t_{i,T})$ and $V(t_{i,T})$ will vary as the lag length included in the ADF regression varies. They tabulate $E(t_{i,T})$ *and* $V(t_{i,T})$ for different lag lengths. In practice, however, to make use of their tables, we are restricted implicitly to using the same lag length for all the ADF regressions for individual series. IPS also suggest an LR-bar test based on likelihood ratio statistics, but we shall concentrate our discussion on their t-bar test. The same arguments apply to the LR-bar test.

3.7.1.3 Fisher's Test

It should be noted that the IPS test is for testing the significance of the results from N independent tests of a hypothesis. There is a large amount of literature on this issue dating back to Tippett (1931) and Fisher (1932). This problem has been studied under the title `Meta-Analysis' and the different tests are reviewed in Hedges and Olkin (2014). All these procedures depend on different ways of combining the observed significance levels (p-values) from the different tests. If the test statistics are continuous, the significance levels π_i $(i = 1, 2, \dots, N)$ are independently uniform (0, 1) variables, and $-2\ \log_e \pi_i$ has a χ^2 distribution with two degrees of freedom. Using the additive property of the χ^2 variables, we get $\lambda = -2\ \sum_{i=1}^{N} log_e\, \pi_i$ has a χ^2 distribution with $2N$ degrees of freedom. This is the test suggested by Fisher (1932). Pearson suggested a slight modification of this, and the Fisher test goes under the name of p_λ test. It is discussed in Rao (1952, p. 44) and by Maddala (1977, p. 47) but there have not been many econometric applications of this test. Tippett suggested using the distribution of the smallest of the p-values, π_i There have been several other suggestions about the p-value combinations. Becker (1977) lists 16 of them, but no *p*-value combination is the most powerful. However, the Fisher test based on the sum of the log of *p*-values has been widely recommended. The advantage of this test is that it does not require a balanced panel as in the case of the IPS test. Also, one can use different lag lengths in the individual ADF regression. Another advantage of the Fisher test is that it can also be carried out for any derived unit root test. The disadvantage is that the p-values must be derived by Monte Carlo simulation. The IPS test is easy to use because there are ready tables available in the paper for $E\left(t_{i,T}\right)$ and $V\left(t_{i,T}\right)$. However, these are valid only for the ADF test.

3.7.1.4 A comparison of the different tests

The main comparison of different tests is as follow:

(1) The IPS test is claimed to be a generalization of the LL tests. However, it is better viewed as a way of combining the evidence of several independent unit root tests.

(2) Im-Pesaran-Shin present a power comparison of the LL and IPS tests and argue that the IPS test is more powerful than the LL test. However, the power comparison is not valid. Although the null hypothesis is the same in the two tests, the alternative hypothesis is different. The LL tests are based on homogeneity of the autoregressive parameter

(although there is heterogeneity in the error variances and the serial correlation structure of the errors). Therefore, the tests are based on pooled regressions. The IPS test, on the other hand, is based on heterogeneity of the autoregressive parameter. As argued earlier, the test amounts to a combination of different independent tests. There is no pooling of data involved as in the LL tests.

(3) The Fisher test and the IPS test are directly comparable. The aim of both tests is a combination of the significance of different independent tests. The Fisher test is non-parametric; whatever test statistic we use for testing for a unit root for each sample, we can get the p-values π_i and then $-2\sum\log_e \pi_i \sim \chi^2$ with $2N$ d.f., where N is the number of separate samples. The IPS test, on the other hand, is parametric. The distribution of the *t*-bar statistic involves the mean and variance of the *t*-statistics used. IPS compute this for the ADF test statistic for different values of the number of lags used and different sample sizes. However, these tables are valid only if the ADF test is used for the unit root tests. Also, if the length of the time series for the different samples is different, there is a problem using the tables prepared by IPS. The Fisher test does not have any such limitations. It can be used with any unit root test and even if the ADF test is used, the choice of the lag length for each sample can be separately determined. Also, there is no restriction of the sample sizes for different samples (they can vary according to availability of the data).

(4) The Fisher test is an exact test. The IPS test is an asymptotic test. Note that this does not lead to a huge difference in finite sample results, since the adjustment terms in the IPS test are derived from simulations while the *p*-values in the Fisher test are also derived from simulations. However, the asymptotic validity of the tests depends on different conditions. For the IPS test the asymptotic results depend on N going to infinity while for the Fisher test, they depend on T going to infinity.

(5) A common finding for many of the tests above is that they tend to be over-sized. That is, when the null hypothesis is true the tests tend to reject more frequently than their nominal size (5%) suggests.

(6) many tests do not perform very well when the error terms are cross-sectionally correlated, or in the presence of cross-country cointegration. For example, when real exchange rates are I (1) and cointegrated across countries the null hypothesis tends to be rejected too often (see Banerjee et al. 2005, for an illustration).

(7) Hlouskova and Wagner (2006) perform a large-scale simulation study to investigate the performance of many alternative first-generation panel unit root and stationary tests. One of their main conclusions is that the panel stationary tests of Hardi (2000) and Hardi and Larsson (2005) perform very poorly. Westerlund and Breitung (2013) summarize a number of critical issues of panel unit roots test, with particular emphasis on the tests of Levin, Lin and Chu (2002) and Im, et al. (2003). These issues mainly relate to the role of deterministic components, serial correlation, cross-sectional dependence and cross-unit cointegration.

In this study, we have panel estimators and therefore the data process identification test must also be panel and stationary. The advantages of panel unit root tests are that they are more efficient because they have a larger sample size and combine time and cross-section information. It is by now a generally accepted argument that the commonly used unit root tests like the Dickey-Fuller (DF), augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests lack power in distinguishing the unit root null from stationary alternatives, and that using panel data unit root tests is one way of increasing the power of unit root tests based on a single time series (Maddala and Wu 1999). See, for example, the arguments in Oh (1996), Wu (1996), MacDonald (1996) and Frankel and Rose (1996), who try to resurrect the purchasing power parity (PPP) theory using panel data unit root tests.

Overall, this research applies panel unit root tests developed by Levin et al. (LLC), and and Im et al. (IPS), since, in particular, for panel data with large time series, the LLC test has an asymptotic normal distribution. Also, for IPS, the heterogeneity of the test assumption helps to provide a more comprehensive examination in this study.

3.8 Panel Granger causality tests

The structures of the causal relationships between variables were analysed through the Granger causality approach. The Granger causality test is a statistical hypothesis test for determining whether one time series is useful for forecasting another. If probability value is less than any α level, then the hypothesis would be rejected at that level.

As understanding the direction of oil volatility' behaviour is important for their eventual significance, studying such patterns becomes important for this research, which is interested in whether oil futures volatility could explain government spending behaviour. Granger (1969) will serve as a complementary econometrics tool in estimating such relationships. The model uses Vector Autoregression (VAR) specification in examining the relationship between variables. This approach has been widely tested (Quan, 1992; Jiménez-Rodríguez and Sánchez, 2005; Rafiq et al., 2009).

A very important point in understanding oil volatility (one of the keys intended empirical investigations in this thesis) is to know whether changes in one variable might be said to affect or cause subsequent changes in another and if so, how strong is this effect? In order to strengthen potential prediction/s, one needs to be confident of the direction of variable causation. Therefore, for examining the impact of oil volatility Granger causality tests may be used. This is seen in the study of Rafiq et al. (2009) who applied both Granger causality and associated generalised impulse response functions to investigate the impact of crude oil volatility on the Thai economy.

To test a bivariate panel granger causality model specification is:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \gamma^{(k)} y_{it-k} + \sum_{k=1}^{K} \beta^{(k)} x_{it-k} + e_{it} \tag{3.14}$$

Where α_i captures the individual specific effect across i and the coefficients $\gamma^{(k)}$ and $\beta^{(k)}$ are implicitly assumed to be constant for all i. The pioneering work on the panel Granger causality test by Holtz-Eakin et al. (1988) involves testing the null hypothesis that $\beta^{(1)} = \cdots = \beta^{(k)} = 0$ against the causality from x to y for all the cross-sectional units (Lin and Ali 2009).

The Granger causality tests in OPEC and non-OPEC countries are as follows:

$$\Delta lnOilDV_{it} = \alpha_{1t} + \sum_{l=1}^{m,lnOilDV_i} \beta_{1i,l}\, \Delta lnOilDV_{it-l} + \sum_{l=1}^{m,lnSPEND_i} \gamma_{1i,l}\, \Delta lnSPEND_{it-l} + \sum_{l=1}^{m,lnINF_i} \delta_{1i,l}\, \Delta lnINF_{it-l} + \sum_{l=1}^{m,lnR\_EXCH_i} \omega_{1i,l}\, \Delta lnR\_EXCH_{it-l} + \sum_{l=1}^{m,lnR\_GDP_i} \vartheta_{1i,l}\, \Delta lnR\_GDP_{it-l} + e_{1it}$$

$$\Delta lnSPEND_{it} = \alpha_{2t} + \sum_{l=1}^{m,lnOilDV_i} \beta_{2i,l}\, \Delta lnOilDV_{it-l} + \sum_{l=1}^{m,lnSPEND_i} \gamma_{2i,l}\, \Delta lnSPEND_{it-l} + \sum_{l=1}^{m,lnINF_i} \delta_{2i,l}\, \Delta lnINF_{it-l} + \sum_{l=1}^{m,lnR\_EXCH_i} \omega_{2i,l}\, \Delta lnR\_EXCH_{it-l} + \sum_{l=1}^{m,lnR\_GDP_i} \vartheta_{2i,l}\, \Delta lnR\_GDP_{it-l} + e_{2it}$$

$$\Delta lnINF_{it} = \alpha_{3t} + \sum_{l=1}^{m,lnOilDV_i} \beta_{3i,l}\, \Delta lnOilDV_{it-l} + \sum_{l=1}^{m,lnSPEND_i} \gamma_{3i,l}\, \Delta lnSPEND_{it-l} + \sum_{l=1}^{m,lnINF_i} \delta_{3i,l}\, \Delta lnINF_{it-l} + \sum_{l=1}^{m,lnR\_EXCH_i} \omega_{3i,l}\, \Delta lnR\_EXCH_{it-l} + \sum_{l=1}^{m,lnR\_GDP_i} \vartheta_{3i,l}\, \Delta lnR\_GDP_{it-l} + e_{3it} \quad (3.15)$$

$$\Delta lnR\_EXCH_{it} = \alpha_{4t} + \sum_{l=1}^{m,lnOilDV_i} \beta_{4i,l}\, \Delta lnOilDV_{it-l} + \sum_{l=1}^{m,lnSPEND_i} \gamma_{4i,l}\, \Delta lnSPEND_{it-l} + \sum_{l=1}^{m,lnINF_i} \delta_{4i,l}\, \Delta lnINF_{it-l} + \sum_{l=1}^{m,lnR\_EXCH_i} \omega_{4i,l}\, \Delta lnR\_EXCH_{it-l} + \sum_{l=1}^{m,lnR\_GDP_i} \vartheta_{4i,l}\, \Delta lnR\_GDP_{it-l} + e_{4it}$$

$$\Delta lnR\_GDP_{it} = \alpha_{5t} + \sum_{l=1}^{m,lnOilDV_i} \beta_{5i,l}\, \Delta lnOilDV_{it-l} + \sum_{l=1}^{m,lnSPEND_i} \gamma_{5i,l}\, \Delta lnSPEND_{it-l} + \sum_{l=1}^{m,lnINF_i} \delta_{5i,l}\, \Delta lnINF_{it-l} + \sum_{l=1}^{m,lnR\_EXCH_i} \omega_{5i,l}\, \Delta lnR\_EXCH_{it-l} + \sum_{l=1}^{m,lnR\_GDP_i} \vartheta_{5i,l}\, \Delta lnR\_GDP_{it-l} + e_{5it}$$

where index i refers to the country, t to the time period ($t = 1, \dots, T$) and l to the lag (where $l = 1, \dots, m$), and e_{it} denotes the white-noise errors.
According to equation (3.15), in country group i, there is Granger causality running only from government spending to oil volatility if in the first equation not all $\gamma_{i,l}$'s are zero but all $\beta_{i,l}$'s, $\delta_{i,l}$'s, $\omega_{i,l}$'s, $and\ \vartheta_{i,l}$ are zero. The *Chi*^{2} statistic tests the null of no causal relationship for any of the cross-section units, against the alternative hypothesis that causal relationship occurs for at least one subgroup of the panel. Rejection of the null hypothesis indicates that one variables Granger causes another, e.g. government spending Granger causes oil volatility for all i.

For example, based on the equation (3.15), we take oil volatility ($OilDV$) and government spending ($SPEND$) variables. Therefore, $\beta_{2i,l}$ is the coefficient of oil volatility and $\gamma_{1i,l}$ is the coefficient of government spending. Accordingly, if the $\gamma_{1i,l}$ the coefficient is significant but the $\beta_{2i,l}$ coefficient is not significant then there is uni-direction in their relationship from government spending to oil volatility. Also, if only the $\beta_{2i,l}$ coefficient is significant, again we have a uni-directional relationship from oil volatility to government spending. However, if both coefficients ($\gamma_{1i,l}, \beta_{2i,l}$) are found to be significant, then this would denote a bidirectional causality. If both coefficients ($\gamma_{1i,l}, \beta_{2i,l}$) are to be found insignificant, so this would represent a no- granger causality between variables.

3.9 Panel generalised impulse response functions: high and low volatility regimes

In this section we analyse the robustness of our results by means of estimating previous specifications of the PVAR for high and low oil volatility regimes.

First, we construct the high and low volatility regimes for all oil volatility proxies, using a Markov Switching modelling approach for each country in our sample (see Appendixes B.7 - B.18).

Following Ching and Chen (2007) and Kurov (2010), we employ a simple mean–variance Markov regime switching model. On the basis that we have 2 potential states (i.e. $s_t = 0$ corresponding to the low volatility and $s_t = 1$, corresponding to the high volatility), the basic regime switching model can be written as in Perlin (2015):

$$OIL\_DEP\_VOL_{i,t} = \mu_{i,0} + \varepsilon_{i,t,0} \sim N(0, \sigma_{i,0}^2) \quad (3.16)$$

$$OIL\_DEP\_VOL_{i,t} = \mu_{i,1} + \varepsilon_{i,t,1} \sim N(0, \sigma_{i,1}^2) \quad (3.17)$$

where, $OIL\_DEP\_VOL_{i,t}$ is the time series under investigation ($i = 0{,}1$ which corresponds to the oil price, oil revenue, and oil rents volatility respectively), is the conditional mean of the series under regime 0, $\mu_{i,1}$ is the conditional mean of the series under regime 1, $\sigma_{i,0}$ is the standard deviation under regime 0, whereas $\sigma_{i,1}$ is the standard deviation under regime 1. Moreover, the $\varepsilon_{i,t}$ of each regime (i.e. 0 or 1) follows normal distribution with zero mean and variance equal to σ_i^2.

The structure of the model as given by Eqs. (3.16) and (3.17) implies that the difference between the two regimes is a mean and volatility shift. In addition, it is assumed that s_t is a latent variable that can only be observed through the behaviour of $y_{i,t}$ and that the regimes have been arbitrarily defined (Hamilton 2009). According to Hamilton (1989), the transition between the various regimes is a stochastic first-order Markov process which implies that the state at time (t), that is, depends only on the previous state, that is, $s_{t-1} = 0{,}1$ (Hamilton, 1989). In other words, s_t depends on certain transition probabilities. Given that the variable s_t can only be observed through the behaviour of $y_{i,t}$, Hamilton (2009) maintains that in order to appropriately describe the probability law relating to $y_{i,t}$, we have to calculate all the necessary parameters for both regimes, which in this case include the average level of the series, the variance of the Gaussian innovation $\varepsilon_{i,t,0}$, as well as the regimes' transition probabilities p and q (where $q = 1 - p$) for each series. We test for the strength and validity of our regime classification by applying Ang and Bekaert (2002) regime classification measure (RCM). This is given by the following formula:

$$RCM = 400\frac{1}{T}\sum_{t=1}^{T} p_t\,(1 - p_t) \tag{3.18}$$

Where $p_t = p(s_t|\Omega_T)$ and Ω_T is the information set corresponding to the entire sample employed in the models. The RCM assumes values between 0 and 100 and lower values consistently entail successful classification of the corresponding regimes (see Appendixes B.7 - B.18).

3.10 Conclusion

The methodology is crucially important for any research test. This chapter has described the methodological approach to be adopted in the research and presented in general terms the statistical methods to be employed. The research adopts positivism research philosophy and deductive approach. A more detailed discussion of the PVAR model is contained in this chapter. In the next chapter, the data chapter is presented.

Chapter 4- Data and Method Description

4.1 Introduction

This chapter focuses on the data for oil volatility in the OPEC and non-OPEC countries. The panel data, sourced from Energy Information Administration and Datastream, comprises of information from 14 countries during the period 1983 to 2015. The choice of the specific time period and countries is purely based on data availability. It is worth noting that our sample countries are all among the largest oil exporters. We use the following three endogenous variables as oil proxies: oil prices, oil rent (% GDP) and oil revenue (% GDP).

The chapter proceeds as follows: The first section, describes the data sample used in our study, and includes data definition and sources. Then, the model framework and the oil volatility are measured. Secondly, macroeconomic data, the choice of macroeconomic variables and preliminary data analysis are presented.

4.2 Data sample

In this study, we anticipate the effects of volatility to be different for the two groups of oil-exporting countries, i.e. OPEC and non-OPEC countries. Firstly, OPEC countries are traditionally considered as oil price setters, while non-OPEC countries are price receivers and generally do not set a price.

In fact, OPEC countries coordinate and unify the petroleum policies of its member states and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income for producers and a fair return on capital for those investing in the industry.

The research sample is divided into two groups: OPEC and Non-OPEC countries to study the effects of oil volatility with the expectation that the different structures between the two groups of countries will create differences in the effects of oil volatility on their economies. Many studies have addressed the structural differences between OPEC and non-OPEC countries. For example, Ramcharran (2002) propose a competition hypothesis for non-OPEC countries and a target revenue hypothesis for OPEC countries. This means that non-OPEC countries have positive price elasticity of supply whilst, OPEC countries display a negative and significant result and attempt to provide a certain amount of target revenue to finance internal investment. Such behaviour is likely to lead to differences in the effects of price and revenue volatility between the two groups. On the differences between the two groups in the oil markets, Kaufmann et al. (2004) provide evidence of OPEC's impact on oil prices and Lin (2009) demonstrate that there is oligopolistic behaviour amongst non-OPEC producers and collusion within OPEC. Schmidbauer and Rösch (2012) find there is evidence of OPEC's effect on oil price volatility with Ghassan and Banerjee (2015) claiming that OPEC countries do not support moderating oil prices whereas, non-OPEC countries oppose any attempt to do so. Therefore, again we can expect the effects of price volatility to be different from revenue volatility between the two groups and therefore if the sample is not segregated, it is likely that errors in the research results may occur.

Additionally, there is evidence of internal structural differences between the two groups. Karl (2005) claims that the economic structure of OPEC countries has focused on the petroleum industry, as this is their primary source of income. Their heavy dependency on oil revenues have prevented these countries' economies from devoting both financial and intellectual capital to the development of other industries. However, non-OPEC oil exporting countries like Norway have diversified their activities and there is no direct injection of oil revenues into the domestic economy and, more importantly, financing the budget has become independent of the oil sector. Moreover, most of the OPEC members are developing countries with less diversified economies, which results in oil revenue being an important part of government funding. Therefore, the effects of the oil volatility in the OPEC and non-OPEC groups are different and, it is therefore important to analyse the position in both.

In this study, the sample based on data availability consists of seven oil-exporting OPEC countries: Algeria, Ecuador, Iran, Qatar, Nigeria, Venezuela and Gabon and seven oil-exporting non-OPEC countries which are members of the Organization for Economic Co-Operation and Development: Mexico, Norway, United Kingdom, Brazil, Tunisia, Egypt and Oman. The countries included in our dataset are listed in Table 4.1. Russia and the United States of America are excluded from this study because, in the case of the former there is a paucity of data and the latter is a net importer for the larger period during which this study was completed.

Table 4.1. List of the 14 Countries in the Sample

OPEC	NON-OPEC
Algeria	Mexico
Ecuador	Norway
Iran	United Kingdom
Qatar	Brazil
Nigeria	Tunisia
Venezuela	Egypt
Gabon	Oman

4.2.1 Oil OPEC countries

According to the OPEC annual statistical bulletin 2018, 81.9% of the world's proven crude oil reserves are located in OPEC member countries, with the bulk of OPEC oil reserves in the Middle East, amounting to 65.4% of the OPEC total. OPEC Member Countries have made substantial additions to their oil reserves in recent years, by adopting, for instance, best practices in the industry, undertaking intensive explorations leading to enhanced recoveries. Consequently, OPEC's proven oil reserves currently stand at 1,214.21 billion barrels (OPEC 2018).

The seven oil-exporting OPEC countries in our sample are Algeria, Ecuador, Iran, Qatar, Nigeria, Venezuela and Gabon. According to data provided by OPEC (2018) Table 4.2 shows world crude oil exports by OPEC countries. It is a stylised fact that Saudi Arabia is the world's largest oil exporter, followed by Iraq and United Arab Emirates. On the other hand, Ecuador, Gabon and Equatorial Guinea have the lowest share of exports in the OPEC countries. In total, oil exporting OPEC countries provided 55.5 % of global world crude oil exports in 2017.

Table 4.2. OPEC member's crude oil exports in 2017

Country	Crude oil exports (1000 b/d)	Share in OPEC %	Share in world %
Saudi Arabia	6968.3	28.0	15.6
Iraq	3802.0	15.3	8.5
United Arab Emirates	2378.7	9.6	5.3
IR Iran	2125.0	8.5	4.7
Kuwait	2010.0	8.1	4.5
Nigeria	1811.1	7.3	4.0
Venezuela	1596.4	6.4	3.6
Angola	1576.7	6.3	3.5
Libya	792.1	3.2	1.8
Algeria	632.6	2.5	1.4
Qatar	466.0	1.9	1.0
Ecuador	385.4	1.6	0.9
Gabon	188.4	0.8	0.4
Equatorial Guinea	128.2	0.5	0.3
OPEC	24860.9	-	55.5
World	44753.3	-	-

4.2.2 Oil non-OPEC countries

Oil-exporting non-OPEC countries considered in this research are Mexico, Norway, United Kingdom, Brazil, Tunisia, Egypt, and Oman. Regarding the oil-exporting non-OPEC countries Norway is the largest crude oil exporter in Europe (OPEC 2018). This country exported 1.3 million barrels of oil per day in 2017, and approximately 98% of exports went to European countries (Boldanov et al. 2016). Table 4.3 illustrates that Mexico exported almost 1.2 million barrels of oil per day in 2017 that is equal to 2.8% of world total crude oil exports. Additionally, Brazil, Oman, and United Kingdom exported 2.5%, 1.8% and 1.5% respectively in 2017. On the other hand, Egypt and Tunisia had the lowest oil exports in the world with exports of nearly 100,000 barrels per day in 2017 OPEC (2018).

Table 4.3. Selected Non-OPEC Countries crude oil exports in 2017

Country	**Crude oil exports (1000 b/d)**	**Share in Non-OPEC %**	**Share in world%**
Norway	1362.1	6.8	3
Mexico	1264.6	6.4	2.8
Brazil	1127.4	5.7	2.5
Oman	803	4	1.8
United Kingdom	693.1	3.5	1.5
Egypt	139.3	0.7	0.3
Tunisia	141.1	0.7	0.3
Non-OPEC	19892.4	-	44.4
World	44753.3	-	-

4.3 Oil volatility proxies

In this section, we will generate three proxies to measure oil volatilities: oil price volatility, oil revenues volatility, and the oil rent volatility. In the following section, the data used, and the methodology of estimation is introduced, and results of proxies reported.

4.3.1 Oil price volatility

4.3.1.1 Data

We construct annual oil price volatilities based on the monthly prices for Brent crude oil price over the period from January 1983 through to December 2015. Brent prices have been collected in US dollars but then transformed into local currency at a monthly frequency for both OPEC and non-OPEC countries (Ghassan and AlHajhoj 2016). The Brent crude oil price is used for analysis as the prices generated in the Brent basket compose the main price benchmarks on the basis of which 70% of international trade in oil is directly or indirectly priced (Fattouh 2010). All data for OPEC and non-OPEC countries have been extracted from DataStream, whereas the data for Brent crude oil prices have been collected from the Energy Information Administration.

4.3.1.2 Model framework: GARCH conditional volatility

Volatility is measured by means of conditional volatility by Lee et al. (1995), Boldanov et al. (2016) and Chen and Hsu (2012), which can be defined as the conditional standard deviation of returns given the most recently available information. The conditional variance process for log-returns, y_t, can be described by conditional movement given the information set I_{t-1} denoted as $V(y_t \backslash I_{t-1}) \equiv \sigma_t^2$.

We implement the standard GARCH(1,1) model proposed by Bollerslev (1986) and Chen and Hsu (2012) to generate conditional volatility of monthly log-returns. On the other hand, despite the fact that the GARC(1,1) model has its own drawbacks, it provides a simple and successful way to capture volatility clustering (Hansen and Lunde 2005). The univariate GARCH(p, q) model is estimated under assumption of a Student t distribution (Boldanov et al. 2016):

The monthly oil price return was generated as the log-difference,

$$y_t = LOG\left(\frac{P_t}{P_{t-1}}\right), \tag{4.1}$$

$$y_t = \ c_0 + \varepsilon_t \tag{4.2}$$

$$\varepsilon_t = \ \sigma_t z_t \tag{4.3}$$

$$\sigma_t^2 = \ \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \tag{4.4}$$

$$z_t \sim t(0,1; v) \tag{4.5}$$

$$f(t) = \frac{\Gamma\left(\frac{v+1}{2}\right)}{\Gamma\left(\frac{v}{2}\right)\sqrt{(v-2)\pi}} \left(1 + \frac{zt^2}{(v-2)}\right)^{-(v+1)/_2} \tag{4.6}$$

where P_t reflects the monthly oil price at the given time t, y_t is first differential of log-difference of P_t , ε_t is the demeaned return at time t, σ_t^2 is the monthly conditional variance at time t, z_t represents the sequence of identically distributed standardized residuals and $(0,1; v)$ is the Student t density function, $\alpha_0, \alpha_i, \ldots, \beta_j$ are parameters of the model and $i, j$are the lag orders. The parameters α_0, α_i and β_j are non-negative, where $\alpha_0 > 0, \alpha_i, \beta_j \geq 0$ whereas $v > 2$ is the degrees of freedom. The rationale for using Student t distribution is that GARCH models often have an issue in capturing the thick tails property of financial time series and it is recommended to apply non-normal distributions to better model this excess kurtosis (Bollerslev 1987; Kaiser 1996; Peters 2001; Beine et al. 2002; Boldanov et al. 2016).[1]

The present study focuses on annual GARCH conditional volatility, which is calculated by taking the square root of the sum of the monthly conditional variance and then multiplied by the square root of 12. Merton (1980) has presented the concept of employing high frequency data to capture the volatility at lower frequency. In addition, empirical results indicate that GARCH models with high frequency data deliver accurate volatility assessments (Andersen and Bollerslev 1997, 1998). As a result, the annual conditional volatility (OilV) is calculated as follows:

$$OilV = \sqrt{12 \sum_{t=1}^{\tau} \sigma_t^2}, \qquad (4.7)$$

where τ =12 is the number of months per year.

4.3.1.3 OPEC and non-OPEC oil price volatility

We estimated the oil price volatility during the period of 1983 to 2015. Figures 4.1 and 4.2 show the oil price volatility for seven oil exporting OPEC countries and the oil price positive volatilities using GARCH conditional variances for selected non-OPEC countries:[2]

[1] We have analysed for auto-correlation, heteroscedasticity and the adequacy of the Student t distribution and the test statistics confirm the validity of our model specification. The lag orders p, q were chosen based on the SBC criterion of Schwarz (1978). We have also examined for ARCH effects on the annually volatility series and the findings are highly statistically significant.

[2] The estimated output of the GARCH (1,1) models can be found in Appendixes A.1-A.14.

Figure 4.1. Oil price volatility for seven oil exporting OPEC countries

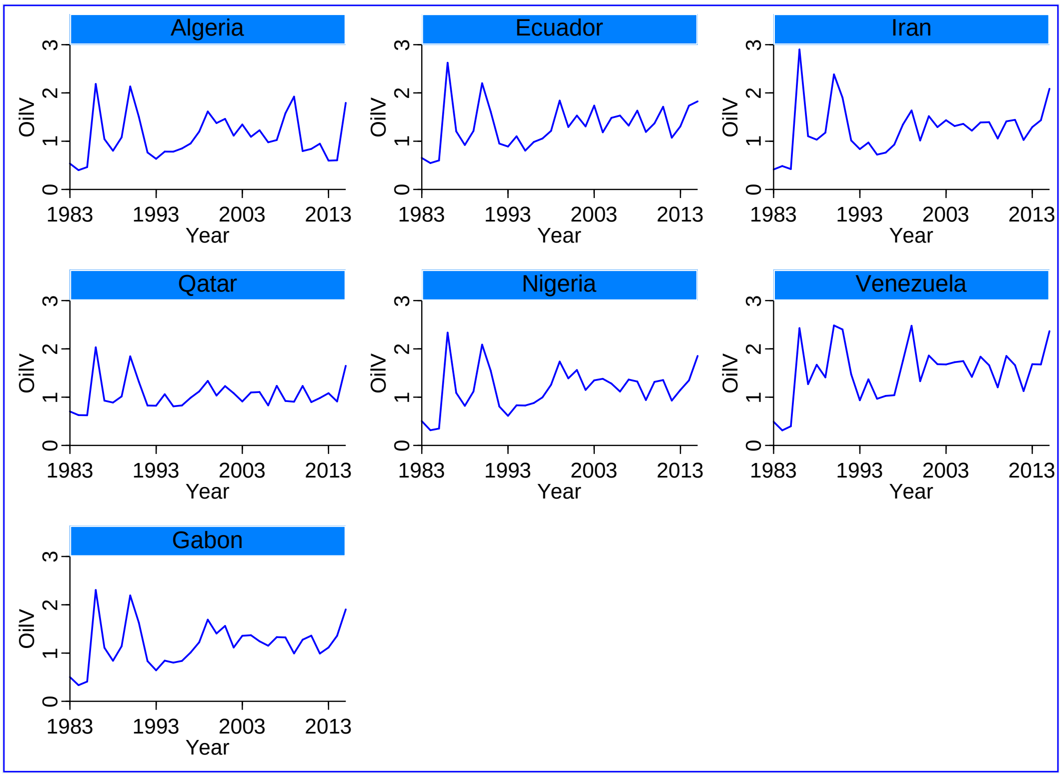
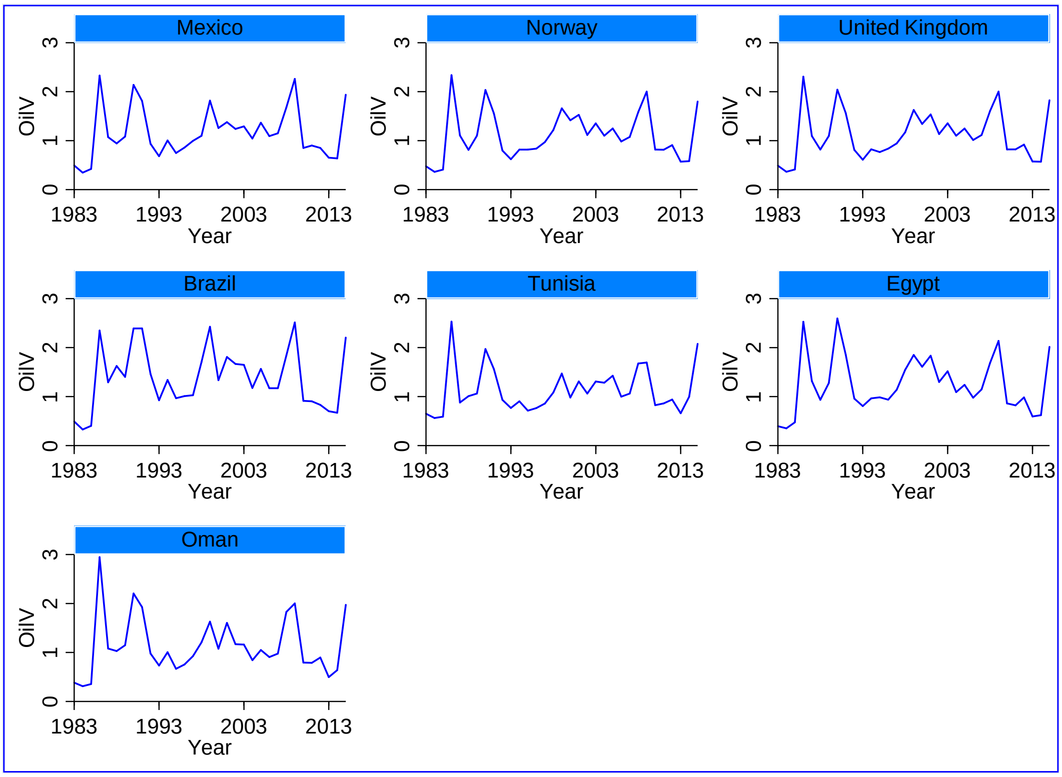


Figure 4.2. Oil price volatility for seven oil exporting non-OPEC countries



According to Figures 4.1 and 4.2, in 1986, estimated oil price volatility is rising, which coincided with the 1986 oil price collapse because of the failure of OPEC to control prices and Saudi Arabia's decision to increase its market share (Gately et al. 1986). After that, in 1990, another oil shock occurs due to the Gulf war and Iraq oil sanctions (Hamilton 2009) that increased oil price volatility. The next oil price volatility peak was in 1999, which coincided with the East Asian financial crisis, Russia's financial distress, the increase in air temperature in North America and Europe, and OPEC's miscalculations (Anderson 2000). For non-OPEC oil price volatility, we observe two more important spikes in the early 2003 and between 2004 and 2005, respectively. These spikes are associated with the second war in Iraq in 2003 and the period of the highest activity of Atlantic hurricanes in 2004–2005. More specifically, Hurricane Katrina severely damaged ten refineries in the Gulf of Mexico, which resulted in major supply disruptions.

During 2000-2008, oil prices significantly increased reaching $147 in July 2008, due to rising oil demand in countries like China and India. However, the financial crisis in 2008 resulted in a significant decrease in oil prices. This period has been also characterized by demand driven oil price shocks (Hamilton, 2011). This oil price shift led to an increase in oil price volatility in 2008, as seen in Figure 4.2. The main difference between the two sets of countries is that non-OPEC oil price volatility increases during the global financial crises reaching unprecedented levels, however, this did not occur in the OPEC cartel, as seen in Figure 4.1.

Interestingly enough, we do not observe an escalation of oil volatility during the period 2011–2014 (apart from the latter part of 2014) when a number of geopolitical events occurred, such as the Arab spring and the Libyan and Syrian civil wars in both OPEC and non-OPEC countries. At the end of our sample period, we observed a spike in oil volatility (see Figs. 4.1 and 4.2). This is due to the collapse of the oil prices during the second half of 2014 and 2015. The appreciation of dollar, the lack of coordination of OPEC members, the increase in crude oil supply and Iran's nuclear deal possibly resulted in the sharp decline in oil prices in 2015 and the oil price volatility spike.

4.3.2 Oil revenues volatility

4.3.2.1 Data

To measure oil revenue, we multiply oil exports in barrels by the average oil price per year. Once again this is an annual figure, as oil exports for the countries under investigation are available on an annual basis. The sources of these data are OPEC, Datastream and the Energy Information Administration (EIA). Oil revenue reports the value of crude oil exports as % of GDP per capita.

4.3.2.2 Model framework: Absolute Log-Return

Unfortunately, crude oil export revenues are not available in higher frequency for sampled countries, so it is not possible to calculate volatility like the oil price volatility. Therefore, following Forsberg and Ghysels (2007) and Antonakakis et al. (2018) we measured volatility of oil revenue using the absolute value of year-on-year growth rate oil revenue series constructed from annually basis of oil exports and oil price per year:

$$OilrevenueV = ABS(LOG\left(\frac{RV_t}{RV_{t-1}}\right)) \tag{4.8}$$

where RV_t is the revenue of oil exports.

4.3.2.3 OPEC and non-OPEC oil revenue volatility

We plot the oil revenue volatility over the period of 1983 to 2015 in Figures 4.3 and 4.4 for OPEC and non-OPEC countries.

Figure 4.3. Oil revenue volatility for seven oil exporting OPEC countries

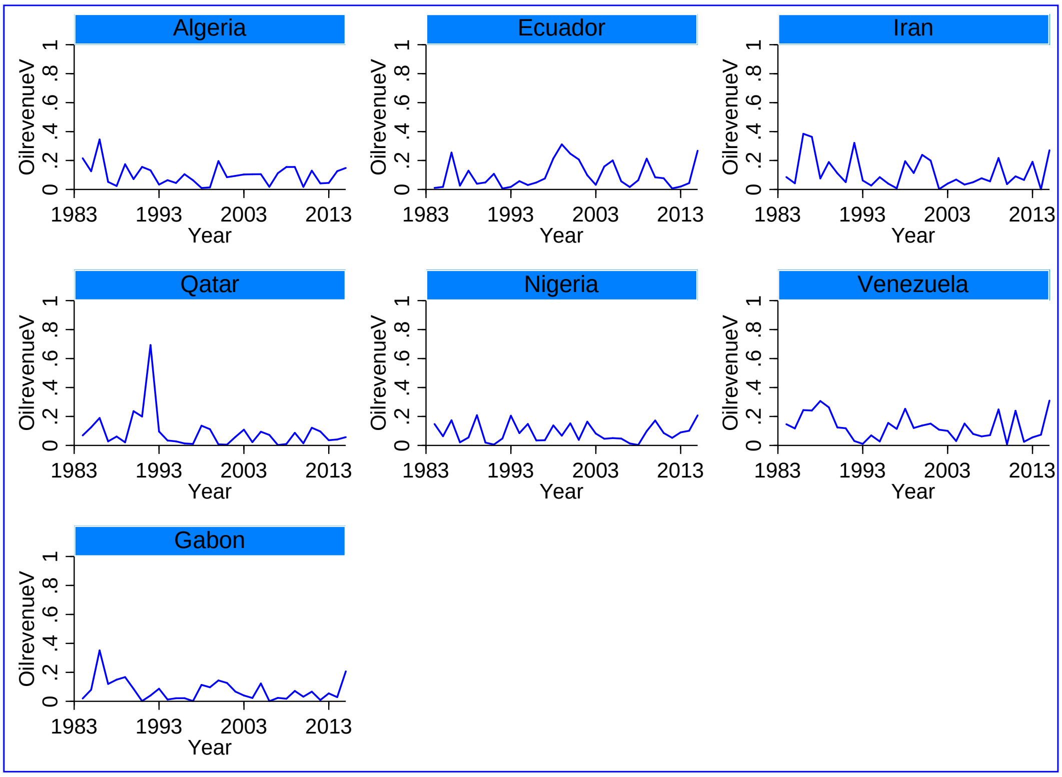
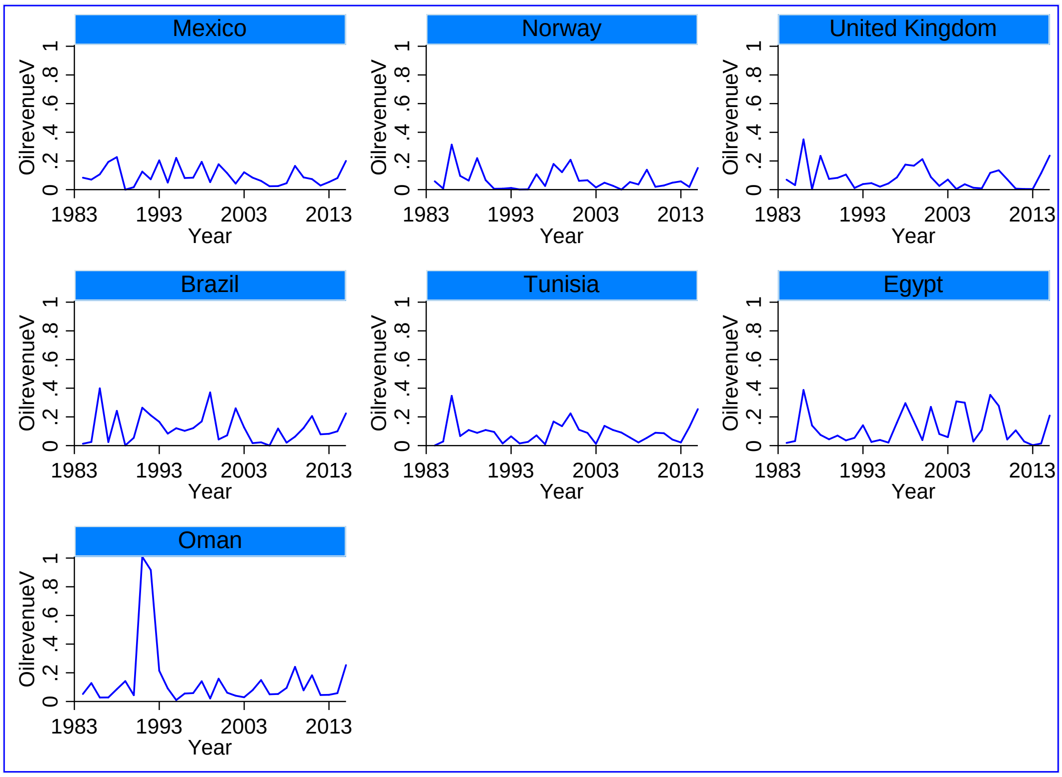


Figure 4.4. Oil revenue volatility for seven oil exporting non-OPEC countries



Reference to Figures 4.3 and 4.4, allows us to observe that oil revenue volatility during 1983 to 2015 for both of OPEC and non-OPEC countries is substantially lower than oil price volatility. For OPEC countries, there is two common peak in oil revenue volatility and oil price volatility, which are in the 1986 and 2015. The common feature of these years is the failure of the OPEC Cartel to control prices, as noted in the previous section. For non-OPEC countries, there are more common peak in oil revenue volatility and oil price volatility. Also, this may indicate that OPEC countries oil revenue does not face the same uncertainty as oil prices and they can adjust uncertainty in oil prices for themselves. So, it can be said that the use of oil revenue volatility, especially for OPEC countries, can reflect more information that may not exist only in oil price volatility (information that is not solely limited to information that available in oil prices).

4.3.3 Oil rent volatility

4.3.3.1 Data

Oil rents are expressed as a percentage of GDP and they are measured annually. All oil rent data used in this research are obtained from the World Bank. More specifically, oil rents (% of GDP) depict the difference between the value of crude oil production at world prices and total costs of production, Antonakakis et al. (2017b).

4.3.3.2 Model framework: Absolute Log-Return

Similar to previous proxy, the oil rents are not available at higher frequencies for sampled countries, thus it is not possible to calculate volatility like the oil price volatility. Therefore, following Forsberg and Ghysels (2007) and Antonakakis et al. (2018) we measured oil rents volatility like as oil revenue volatility, OilrentsV:

$$OilrentsV = ABS(LOG\left(\frac{OR_t}{OR_{t-1}}\right)) \tag{4.9}$$

where OR_t is the oil rent.

4.3.3.3 OPEC and non-OPEC oil rents volatility

The measure of oil rent volatility is shown in Figures 4.5 and 4.6 which plots annually oil rent returns using absolute annual log-returns for selected OPEC and non-OPEC countries from 1983 to 2015.

Figure 4.5. Oil rents volatility for seven oil exporting OPEC countries

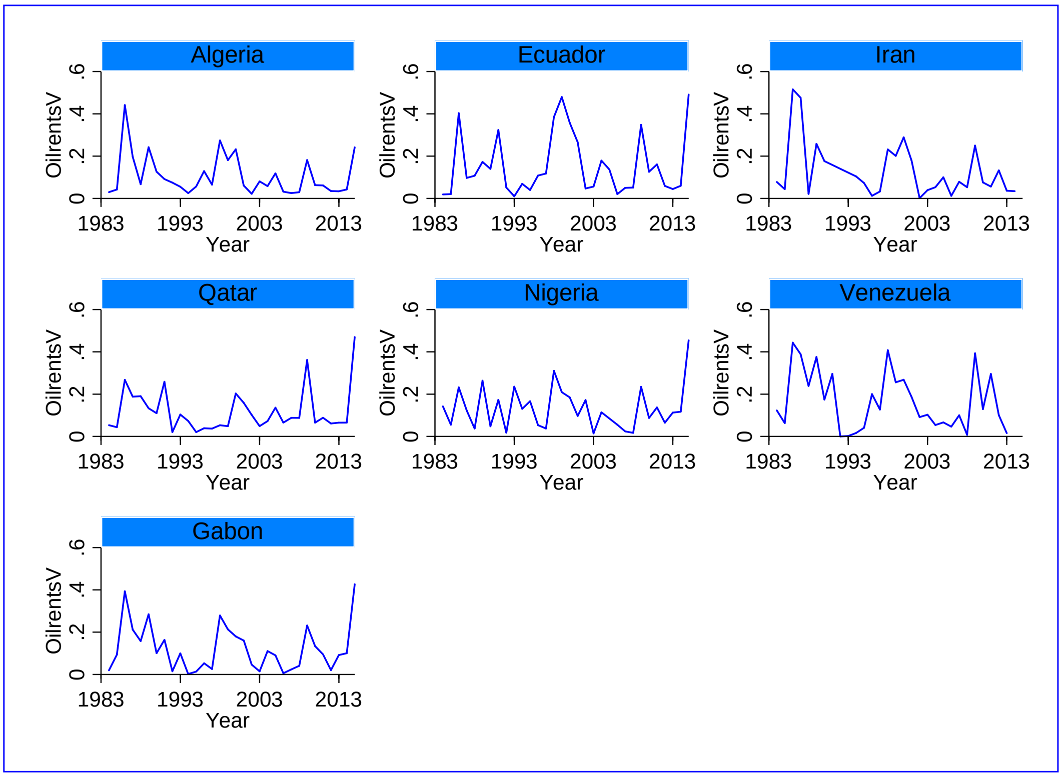
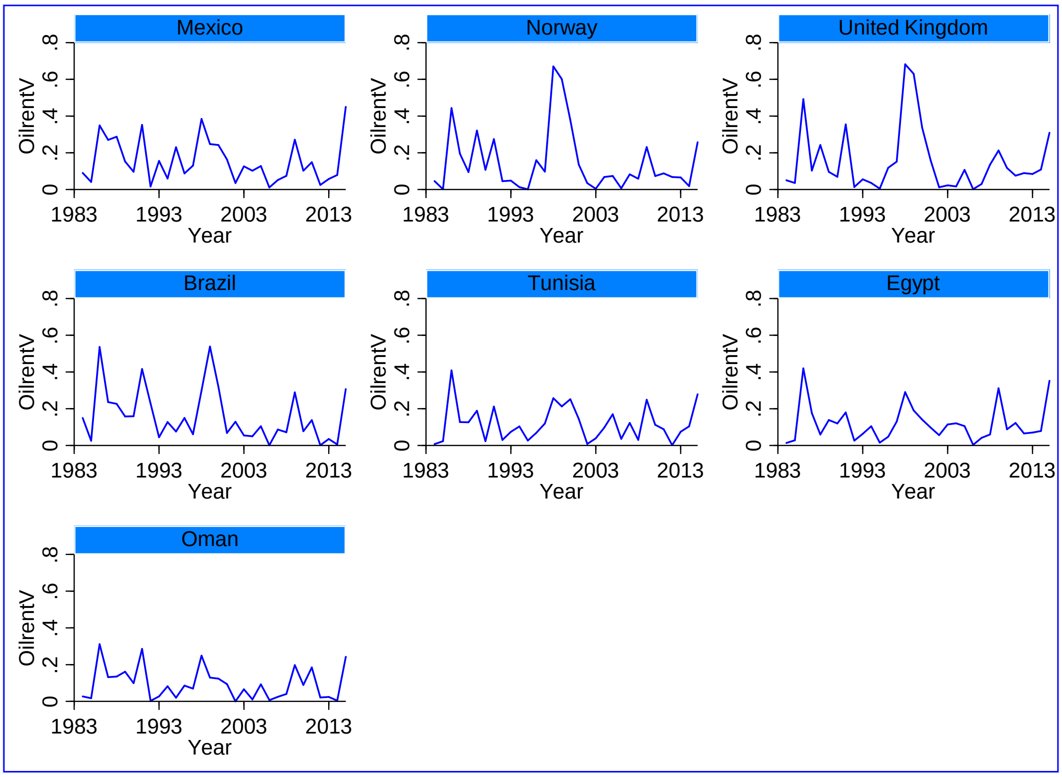


Figure 4.6. Oil rent volatility for seven oil exporting non-OPEC countries



According to Figures 4.5 and 4.6, for the most of countries there are five significant peaks in oil rent volatility in 1986, 1991, 1999, 2009, and 2015. Each of these peaks has been coincidence by oil prices suddenly down or rises, as reviewed in Section 4.3.1.3. For example, oil rent volatility for Iran, Norway, UK and Ecuador in 1999 have a peak because oil prices decline to about 11 $/barrel in 1998 and again rose to 17 $/barrel in next year, which cause to rise the oil rent volatility. Oil production costs in short-term do not change at the same rate as oil prices, so in short-term oil rents are more affected by the spot oil prices.

Generally, as it seen, each of the three proxies introduced in this study have their own characteristics for oil volatility and will reflect information that other proxies it may not have the ability to do so. When oil price volatility can only reflect uncertainties in spot prices of oil market, oil revenue volatility can capture the quantity of oil exports uncertainties, finally oil rents volatility will capture uncertainty in difference between oil revenue and oil production cost. Therefore, the two latter proxies are more specific to each country.

oil price volatility has only market-related uncertainty and does not depend on the internal characteristics of the countries.

Oil rents are the difference between the value of crude oil production and production costs which will be a more accurate indication compared to oil revenues. This variable is used, for example, in the study of Sachs and Warner (2001) Farzanegan (2011) to illustrate the importance of oil within relevant economies. The difference in the impact of oil rent and oil revenue volatility is rooted in production costs, which is included in the oil rents index. When OPEC countries are confronted with uncertainty in oil revenues, this is mainly due to the effect of two factors, exports (demand from importing countries) and oil prices. However, oil rent uncertainty is related to domestic oil production costs and is therefore oil rents are more influenced by domestic economic factors than oil revenue (Farzanegan 2011), since oil rents are more controlled by the domestic economy, we expect oil rents uncertainty to have a more temporary effect compared with oil revenue uncertainty.

Oil rents directly affect the value added of oil upstream and downstream industries. Any uncertainty it could lead to a reduction in the value added of the oil industry and, consequently, economic growth. Therefore, a reduction in the added value of the oil industry has harmed the government’s tax revenue in these countries and then this will reduce government spending on economic growth.

Accounting for the contribution of natural resources to economic output is important in building an analytical framework for sustainable development. In some countries earnings from natural resources, especially from fossil fuels, account for a sizable share of GDP, and much of these earnings come in the form of economic rents - revenues above the cost of extracting the resources. Natural resources give rise to economic rents because they are not produced. For produced goods and services competitive forces expand supply until economic profits are driven to zero, but natural resources in fixed supply often command returns well in excess of their cost of production. Rents from nonrenewable resources - fossil fuels indicate the liquidation of a country's capital stock. When countries use such rents to support current consumption rather than to invest in new capital to replace what is being used up, they are, in effect, borrowing against their future.

The estimates of natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it. This is done by estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP) (World bank, 2011).

4.4 Macroeconomic data

We collect annual data from 1983 to 2015 for macroeconomic variables. The data consists of real GDP per capita (in 2010 US$), nominal exchange rate (LCU)[3] per US$, inflation at consumer prices (annual %) and general government spending (as % of GDP). This is disaggregated to include education spending (as % of GDP), military spending (as % of GDP), and health spending (as % of GDP).

Furthermore, the annual GDP per capita and official exchange rate are generated as the growth rates from using the following formula:

[3] Local Currency Units

$$growth_t = \ln(Z_t) - \ln(Z_{t-1}), \tag{4.10}$$

where Z_t denotes the present value and Z_{t-1} reflects the past value at the given time t. The data for the macroeconomics variables and disaggregated government spending are obtained from the World Development Indicators database maintained by the World Bank, whereas the data for military spending is retrieved from the Stockholm international Peace Research Institute (SIPRI).

4.4.1 Choice of macroeconomics variables

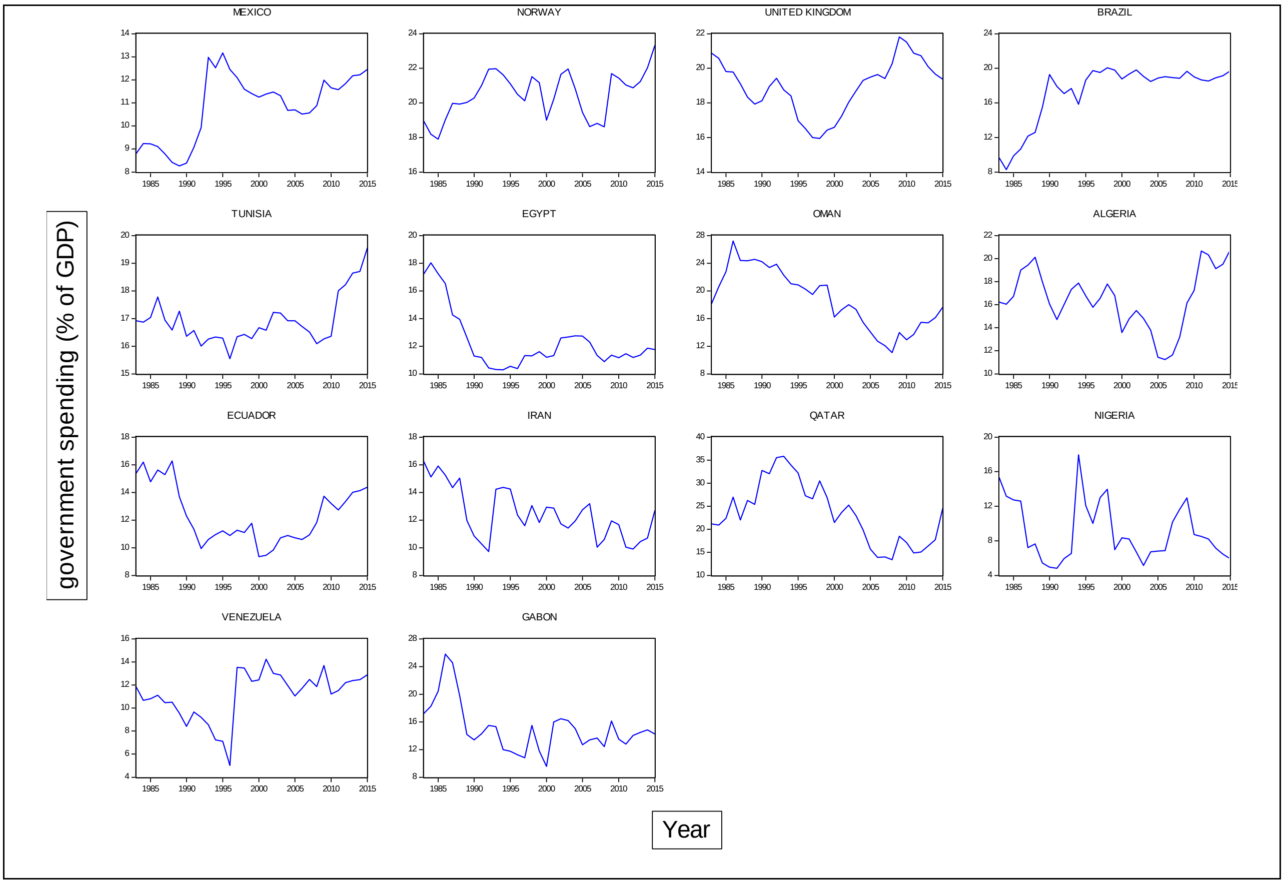
4.4.1.1 General government spending (% of GDP)

The key variable of interest is general government spending (% of GDP) and it provides an indication of the size of government across countries. As shown in the literature review chapter, government spending is heavily dependent on the oil sector in oil exporting countries, (some indicative studies include of (Dees et al. 2008, Farzanegan and Markwardt 2009, Oriakhi and Osaze 2013, Hamdi and Sbia 2013).

Therefore, the government spending behaviour can be significantly changed based on any change in oil prices and associated increase (decrease) in oil price volatility (Fasano-Filho and Wang 2002; Bondzie et al. 2014; Pazouki and Pazouki 2014). Fig. 4.7 shows the general government spending (as % of GDP) in OPEC and non-OPEC countries from 1983 to 2015.

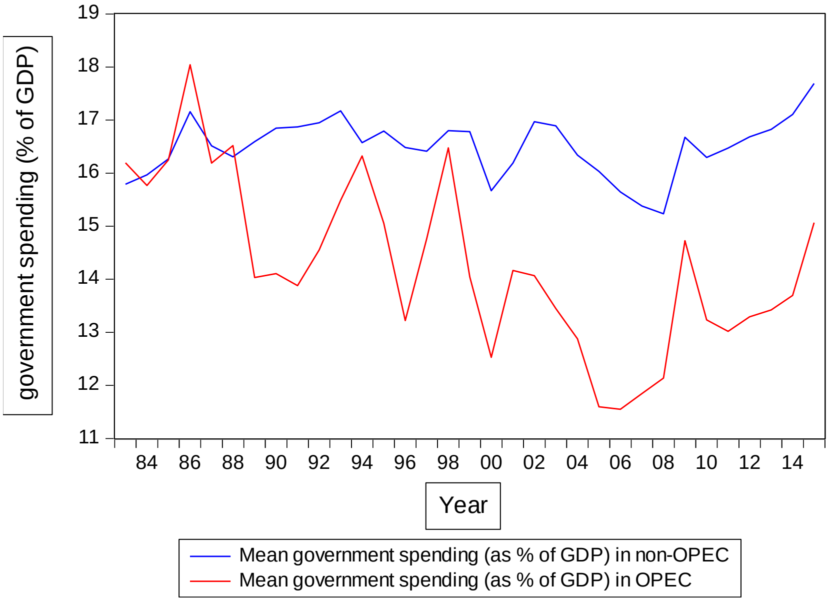
If we look at the general government spending (US $) and GDP (US $), will see that main source of fluctuation in the general government spending as a share of GDP. Norway, Tunisia, UK, Algeria, Iran, and Nigeria are countries that faced with more volatile government spending that caused higher volatility in their government spending (as % of GDP). Mexico, Brazil (until 2000) and Venezuela (in 1997) are countries that faced with an increasing government spending that caused rose in their government spending (as % of GDP).

Figure 4.7. General government spending (% of GDP) in OPEC and non-OPEC countries



By averaging the sample countries, Figure 4.8 is obtained. According to this chart, it is clear that sample countries that are not members of the OPEC have higher government expenditure than OPEC countries. It is also noted that the fluctuation in government spending (% of GDP) in OPEC countries is more than non-OPEC countries. One of the reasons for the higher volatility of government spending in the OPEC countries rather than non-OPEC countries could be that their economies are smaller than non-OPEC countries and they are more exposed to shocks (in case of this study, especially oil shocks). As Furceri and Ribeiro (2008) indicate, the smaller countries not only have more volatile government spending, but, they tend to use government spending more actively. As a result, one of the reasons for the greater volatility of government spending in OPEC countries could be their more exposure to the oil markets uncertainties.

Figure 4.8. Mean of general government spending (% of GDP) in OPEC and non-OPEC countries



4.4.1.2 Disaggregated government spending

There are two broad categories of government spending: current and capital expenditure. The current expenditure aims to maintain the current capacities of government administration. In detail, current expenditure includes the following items: expenditures on goods and services such as wage bills of government employees, employer contribution including social security and pensions, interest payment, subsidies and all other payments which relate to the management of government functions in military, health, and education. The government invests and creates new capacities in infrastructure services and public goods through capital or development expenditures.

The main categories of government spending on the basis of functions are categorized into the following groups for OPEC and non-OPEC countries: military, social security services, education, health services, general services and others. As shown in Figures 4.9 and 4.10, education, health, and military expenditures account for the majority of government expenditures in both sample groups. The apparent distinction between the two groups is OPEC's propensity to spend less on health and education (% of GDP) and more on military spending (% of GDP) compared to the non-OPEC countries.

Figure 4.9. Share of government spending for each function (% of GDP) in OPEC countries

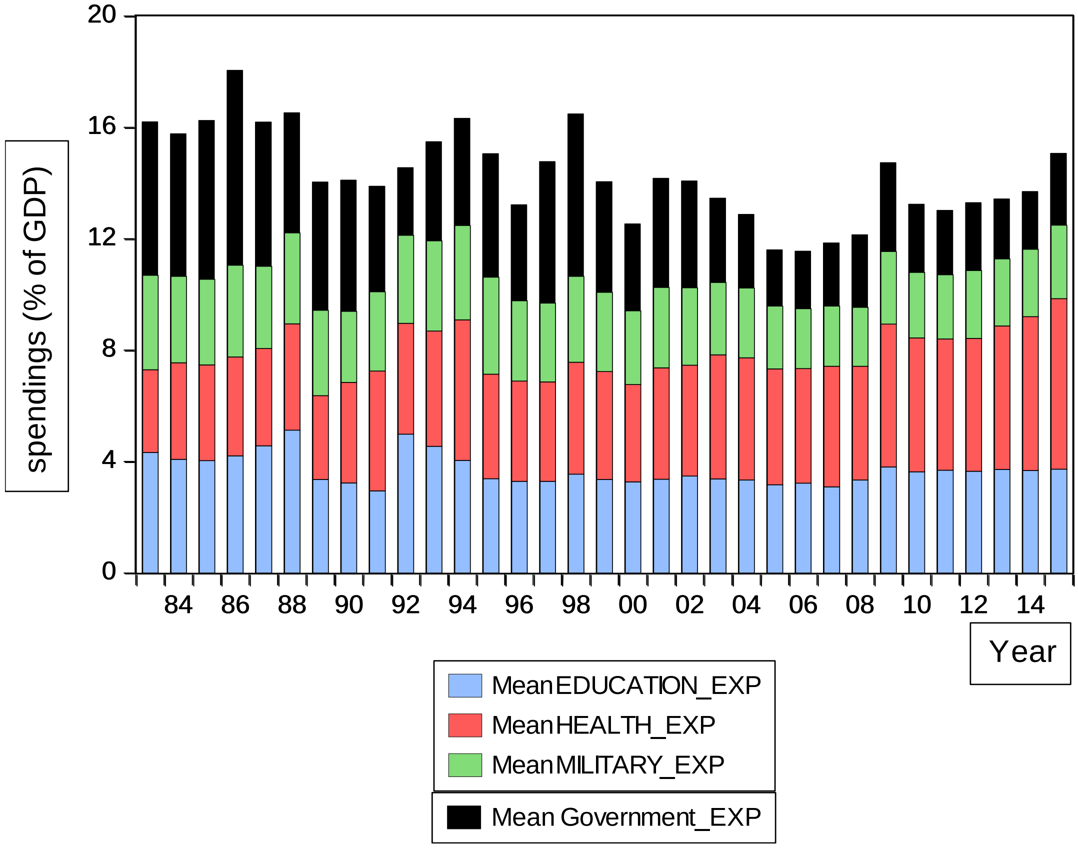
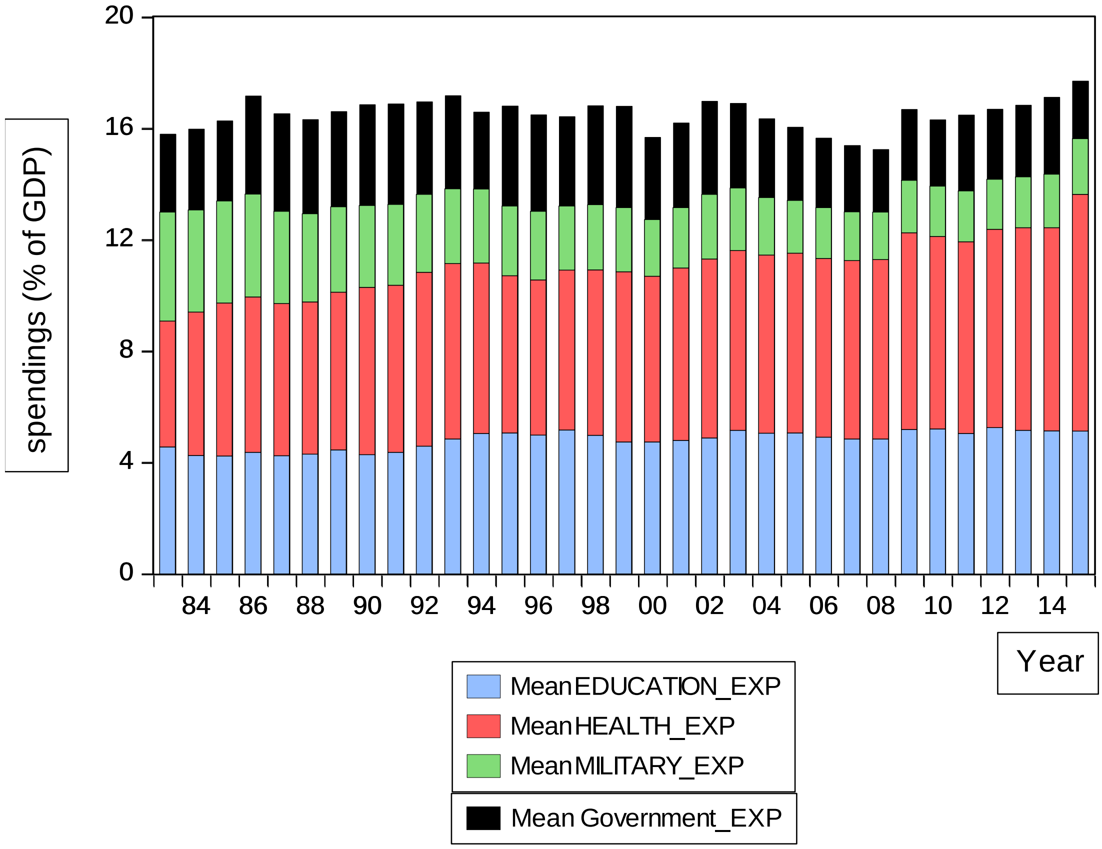


Figure 4.10. Share of government spending for each function (% of GDP) in non-OPEC countries



4.4.1.2.1 ***Education spending***

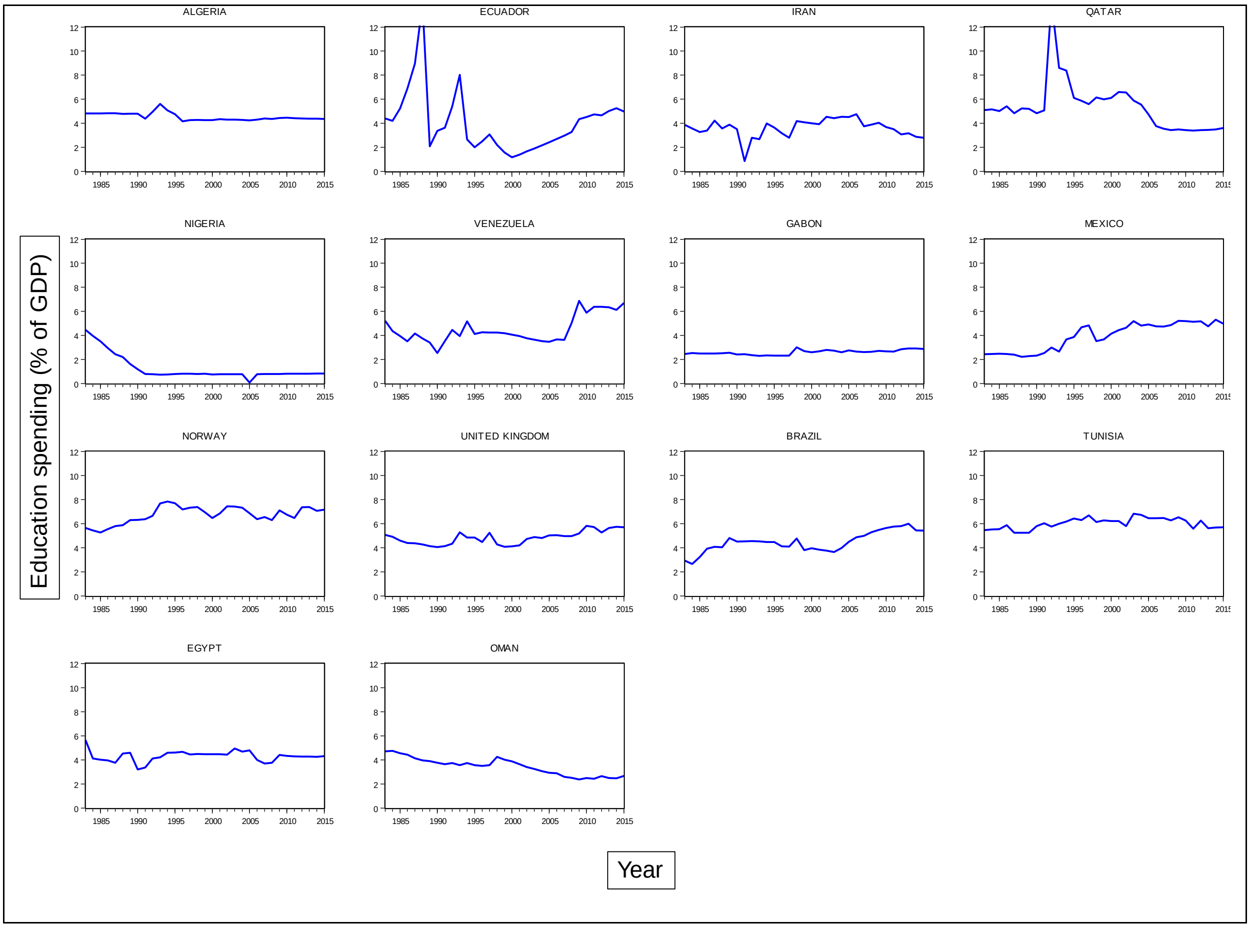
General government expenditure on education includes direct expenditure on educational institutions as well as education related public subsidies given to households and administered by educational institutions. This indicator is shown as a percentage of GDP and of total government spending, divided by primary, primary to post-secondary, non-tertiary and tertiary levels. Public entities include ministries other than ministries of education, local and regional governments, and other public agencies. Public spending includes expenditure on schools, universities and other public and private institutions delivering or supporting educational services. This indicator shows the priority given by governments to education relative to other areas of investment, such as health care, social security, military and security. Education expenditure covers expenditure on schools, universities and other public and private institutions delivering or supporting educational services.

Studies such as Gylfason (2001) have found evidence that countries are dependent on natural resources and, inadvertently or deliberately, neglect the development of their human resources by devoting inadequate attention and expenditure to education. As Karl (2007) states the high skill level needed by oil-rich countries in their leading sector can be bought or imported, their governments do not face the same urgent educational imperatives and may underrate the need for strong educational policies. Flooded with easy money, they may perceive more urgent needs than the long-term investments in education that result in long-term development benefits.

On the other hand, Farzanegan and Thum (2017) claim that the under-spending hypothesis championed by Gylfason (2001) no longer holds with newer data. Their empirical models show a significantly positive effect of oil rents on the quantity of education measured by government spending on primary and secondary education. However, they reported a negative effect of oil rents on the quality of education.

In Fig. 4.11, we present education spending in OPEC and non-OPEC countries for the period 1983-2015. In OPEC member countries, the countries with the highest and lowest percentages of education expenditures are on average in Qatar and Nigeria, respectively. In non-OPEC countries, Norway has the largest share of educational spending, and Oman has the smallest. Also, as noted earlier, OPEC countries have a lower education spend, while expenditure fluctuations are also higher in these countries.

Figure 4.11. Education spending in OPEC and non-OPEC countries



4.4.1.2.2 Military spending

Military expenditure, also called defence budgets, are the volume of resources that a nation allocates for defence purposes and the supply of military forces. Since the provision of security as a public good lie with the central and local governments, military spending is one of the most important budget headings in the annual budgets of all governments.

Military spending often reflects how strongly a country perceives the likelihood of threats against it or the amount of aggression it wishes to conjure. It also gives an idea of how much financing should be provided for the upcoming fiscal year. The size of the spend also reflects the country's ability to fund military activities.

The amount of funds that governments spend on military is affected by many political and geopolitical factors, but it is definitely one of the most important. Factors include the size of that country's economy, other financial demands on it, and the willingness of the government or people to fund such military activity. Generally excluded from military expenditure is spending on internal law enforcement and disabled veteran rehabilitation. The effects of military expenditure on a nation's economy and society, and what determines military expenditure, are notable issues in political science and economics. Hence, in line with the objectives of this study, the analysis of the effects of oil fluctuations on the military expenditure of countries are an important and interesting issue.

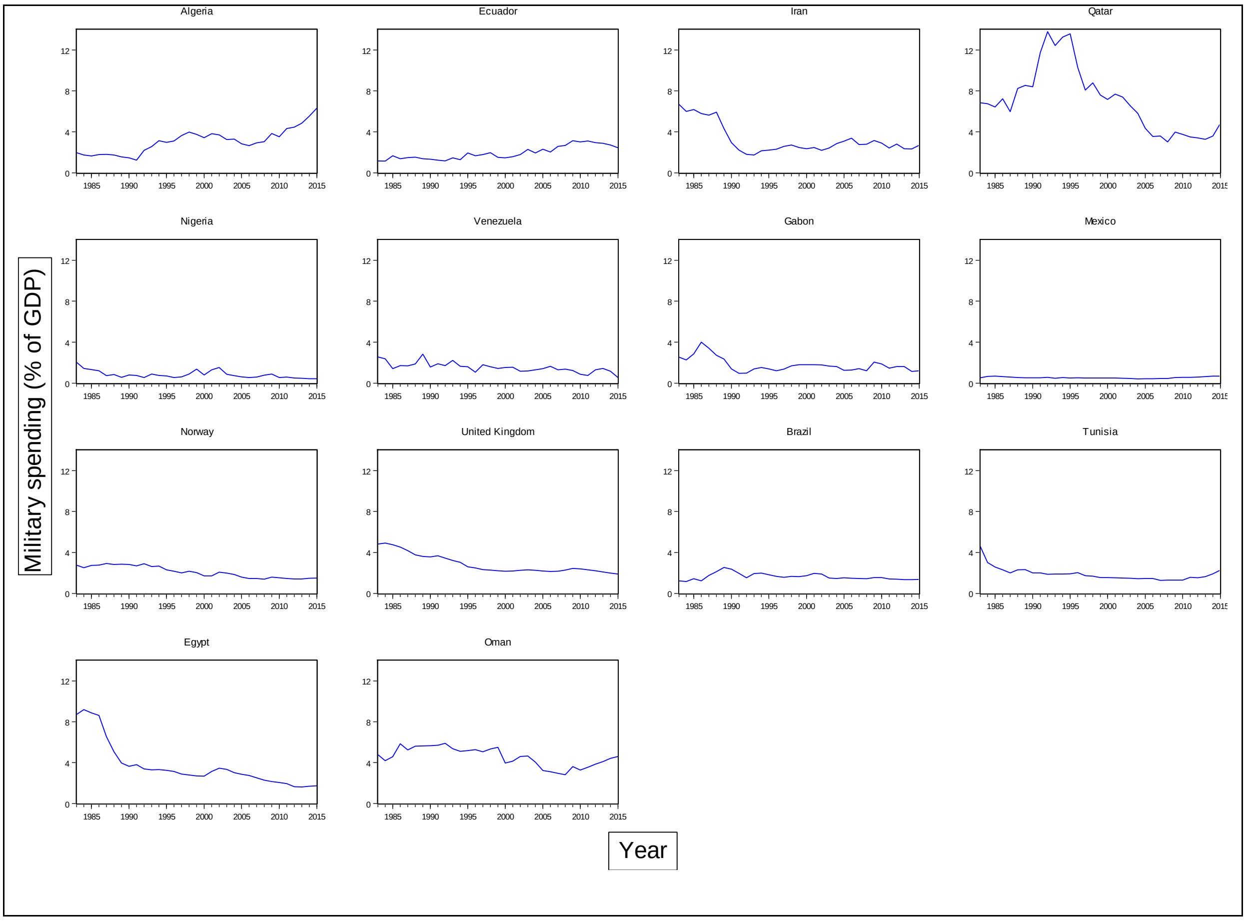
There are controversial findings and theories regarding these topics. Generally, some suggest a positive impact of military expenditure on economic growth (Farzanegan 2014; Deslia et.al 2017), however, some papers such as Korkmaz (2015) contradict these findings concluding that the effect is negative.

Oil dependent countries are closely associated with military spending and the creation of vast repressive apparatuses. This is in part due to the fact that superpowers are wary of letting oil reserves fall out of the control of their allies and into the hands of possible opposition groups. As a group, oil exporters spend much more money and a greater percentage of their revenues on their military and security forces than do non-mineral-dependent countries (Gary and Karl 2003). Farzanegan (2011) shows that only the Iranian government's military spending represents a meaningful reaction on positive oil shocks, and that other expenditures do not have a meaningful reaction to oil shocks. However, Chun (2010) concludes that the military expenditures do not react to changes in oil revenues for the five oil countries of Iran, Kuwait, Saudi Arabia, Venezuela and Nigeria.

Therefore, over the last few decades, there has been a considerable attention to the macroeconomic effects of military spending from both policymakers and academics alike. The general argument is that any potential change in the military spending will affect economic growth in an economy (see Barro and Sala-i-Martin 1995; Dunn 1999).

Fig. 4.12 exhibits the military spending in OPEC and non-OPEC economies between 1983 and 2015. Based on these data, there is no common trend in military expenditure of the studied countries. OPEC countries such as Algeria and Ecuador have had rapid growth in military spending. The share of military expenditure in other sample countries was mainly downward or relatively stable. In general, military spending in OPEC countries has been higher than non-OPEC and more volatile.

Figure 4.12. Military spending in OPEC and non-OPEC countries



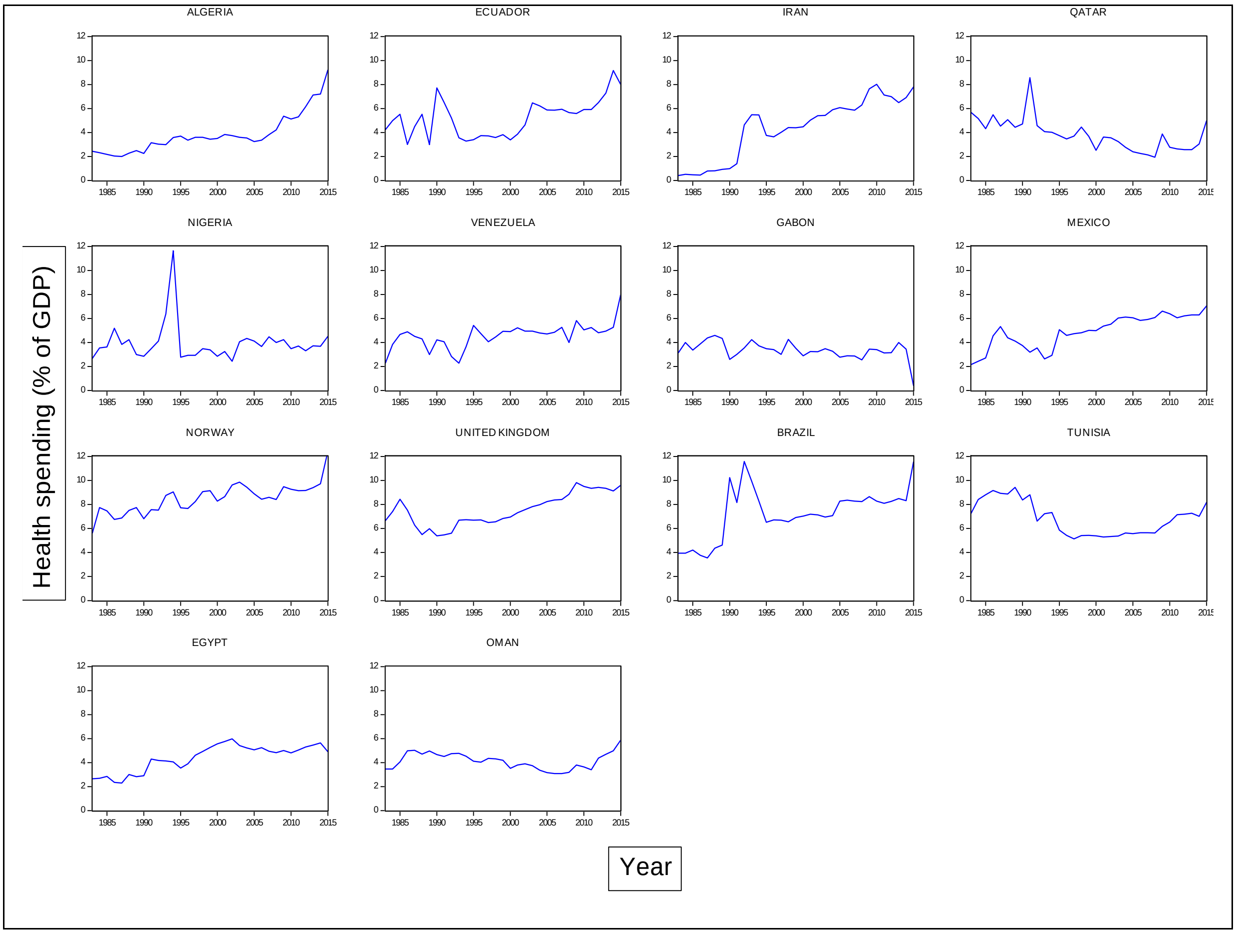
*4.4.1.2.3 **Health spending***

Health spending measures the final consumption of health care goods and services (i.e. current health expenditure) including personal health care (curative care, rehabilitative care, long-term care, ancillary services and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments (Pekar and Binner 2017). Health care is financed through a mix of financing arrangements including government spending and compulsory health insurance ("Government/compulsory") as well as voluntary health insurance and private funds such as households' out-of-pocket payments, NGOs and private corporations ("Voluntary"). This indicator is presented as a total and by type of financing ("Government/compulsory", "Voluntary", "Out-of-pocket") and is measured as a share of GDP, as a share of total health spending and in USD per capita (using economy-wide PPPs).

Health is a normal good (Jack 1999), so more income leads to more spending on health. During the recent five decades, there has been considerable worry about the increasing ratio of GDP devoted to health expenditure (Mehrara and Musai 2011). Thus, much research has focused on the determinants of health expenditure.

One of the most main subjects in health is what determines the funds a country devotes to health. The factor that has been identified as the most dominant is real GDP (see e.g. Tang 2009; Tosetti and Moscone 2010; Hartwig 2008), also as we know, oil export is the main source of government financing and economic growth in most oil exporter countries. On the other hand, countries dependent on oil as their major resource of development are characterized by corruption and exceptionally poor governance, a culture of rent-seeking, often devastating economic, health, and environmental consequences at the local level, and high incidences of conflict and war (Karl, 2004). In this regard, the share of expenditures in health sector from GDP for both group of countries is shown in Figure 4.13. Most countries have increased the share of health expenditure. It is also evident that the share of health expenditures in OPEC countries is lower, since they are developing countries. Also, the variation of health spending in OPEC countries is higher, suggesting that these countries are more likely to change health budgets than non-OPEC countries. Gabon has the lowest share of health expenditure, and Norway has the largest.

Figure 4.13. Health spending in OPEC and non-OPEC countries



4.4.1.3 Other macroeconomic variables

We will use three additional macroeconomic variables for estimating our empirical econometric models. These auxiliary variables will have the effect of influencing the relationship between oil prices and government expenditure and can strengthen or weaken this.

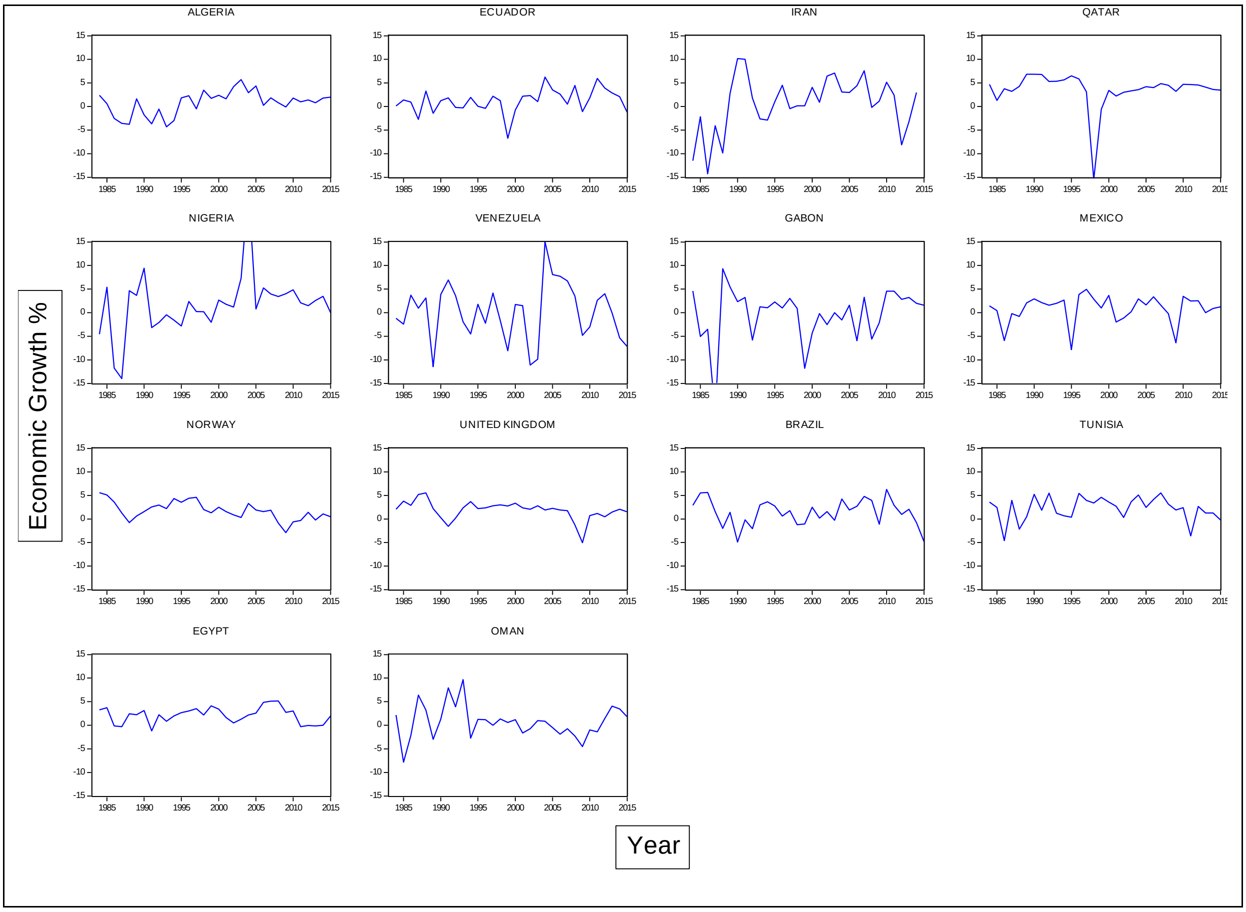
A. GDP:

Oil price changes and fluctuations has a foremost effect on economic growth. These effects are anticipated to be different in oil importing and in oil exporting countries. As a matter of fact, an oil price increase is considered excellent news for oil exporting countries and bad news in oil importing countries. There are many studies, on the impact of oil prices and oil price volatility on GDP, such as Sachs and Warner (1999), Abeysinghe (2001), Guo and Kliesen (2005), Jiménez-Rodríguez and Sánchez (2005), Jones et al. (2004), Elder and Serletis (2010), Esfahani et al. (2013), Cunado et al. (2015), Ju et al. (2016).

According to Wagner's law, which is Keynesian in nature, there is a causal relationship between economic growth and government expenditure and there are studies that find bi-directional causality between them (Abu-Bader and Abu-Qarn 2003). Also, papers like Joerding (1986), Erdil and Hakan Yetkiner (2001), Mallick et al. (2016) find that there is a granger causality relating economic growth to military, health and education expenditures, respectively. Hence, in order to avoid the so-called “omitted-variable bias”, we will use GDP growth as an additional variable in our econometric models.

Fig. 4.14 illustrates the economic growth in OPEC and non-OPEC countries from 1983 to 2015. Therefore, economic growth fluctuates dramatically in most of the OPEC countries such as Iran, Qatar, Nigeria, Venezuela, and Gabon but not in non-OPEC countries.

Figure 4.14. Economic growth in OPEC and non-OPEC countries



B. Exchange rate

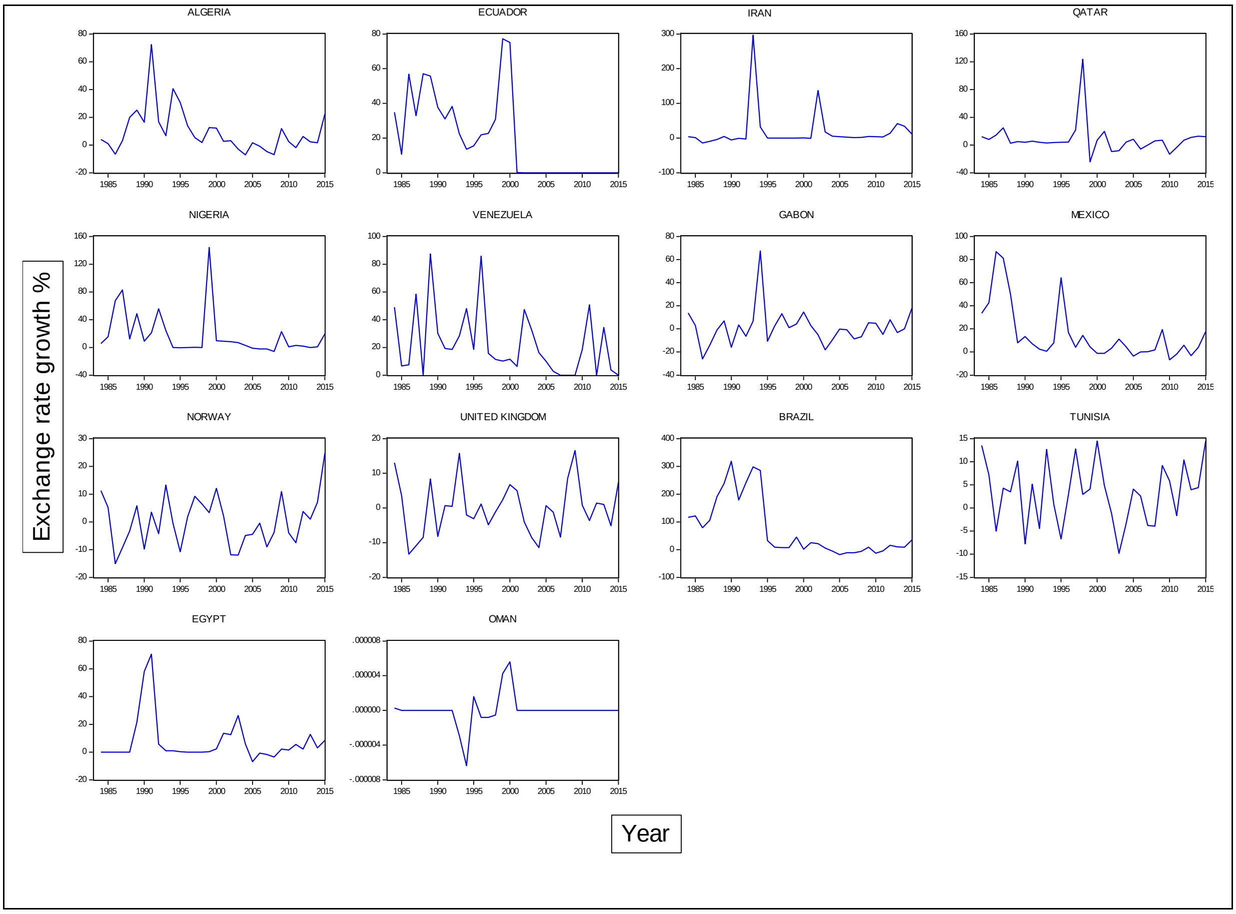
The main driver of terms of trade – the relative price of exports to imports – in oil exporting countries is oil prices. Backus and Crucini (2000) find that the increased volatility in the terms of trade is largely due to the increased volatility in the relative price of oil. Moreover, literature identified the terms of trade as one of the potential determinants of the real exchange rate (Habib and Kalamova 2007). Many empirical studies find a significant relationship between the oil price and the real exchange rate of oil exporting countries (Bergvall 2004; Koranchelian 2005; Zalduendo 2006; Korhonen and Juurikkala 2009). Also, Dauvin (2014) indicates that when the oil market is highly volatile, currencies follow an “oil currency” regime; terms-of-trade becoming an important driver of the real exchange rate.

On the other hand, many papers indicate that exchange rate affects economic growth (Rodrik 2008; Guzman et al. 2018) and prices and inflation (Forbes 2016). Therefore, using exchange rate growth as an additional variable in our econometric models will improve the empirical model's capability.

The growth of exchange rates in OPEC and non-OPEC countries is shown in Fig. 4.15. In this regard, the Iranian Rial collapsed during the eight-year war with Iraq between 1980 and 1988 and also during the period of nuclear sanctions from 2007 to 2013. Also, Nigeria faced some currency crisis. For instance, starting in late 2003, oil prices began to rise steadily from around $30 per barrel till they peaked at $140 per barrel in the middle of 2008. It was also during this period of rising oil prices that Nigeria obtained its $18 billion debt relief from the Paris Club. It was like being in heaven. This, rising oil prices allowed Nigeria’s foreign reserves to increase substantially. There were reserves and there was also the Excess Crude Account (ECA) which had more than $20 billion at one point in 2008.

On the other hand, Brazil as a non-OPEC country had a major financial crisis in 1980s and 1999. Other non-OPEC countries are stable fluctuated during the sample period.

Figure 4.15. Exchange rate in OPEC and non-OPEC countries

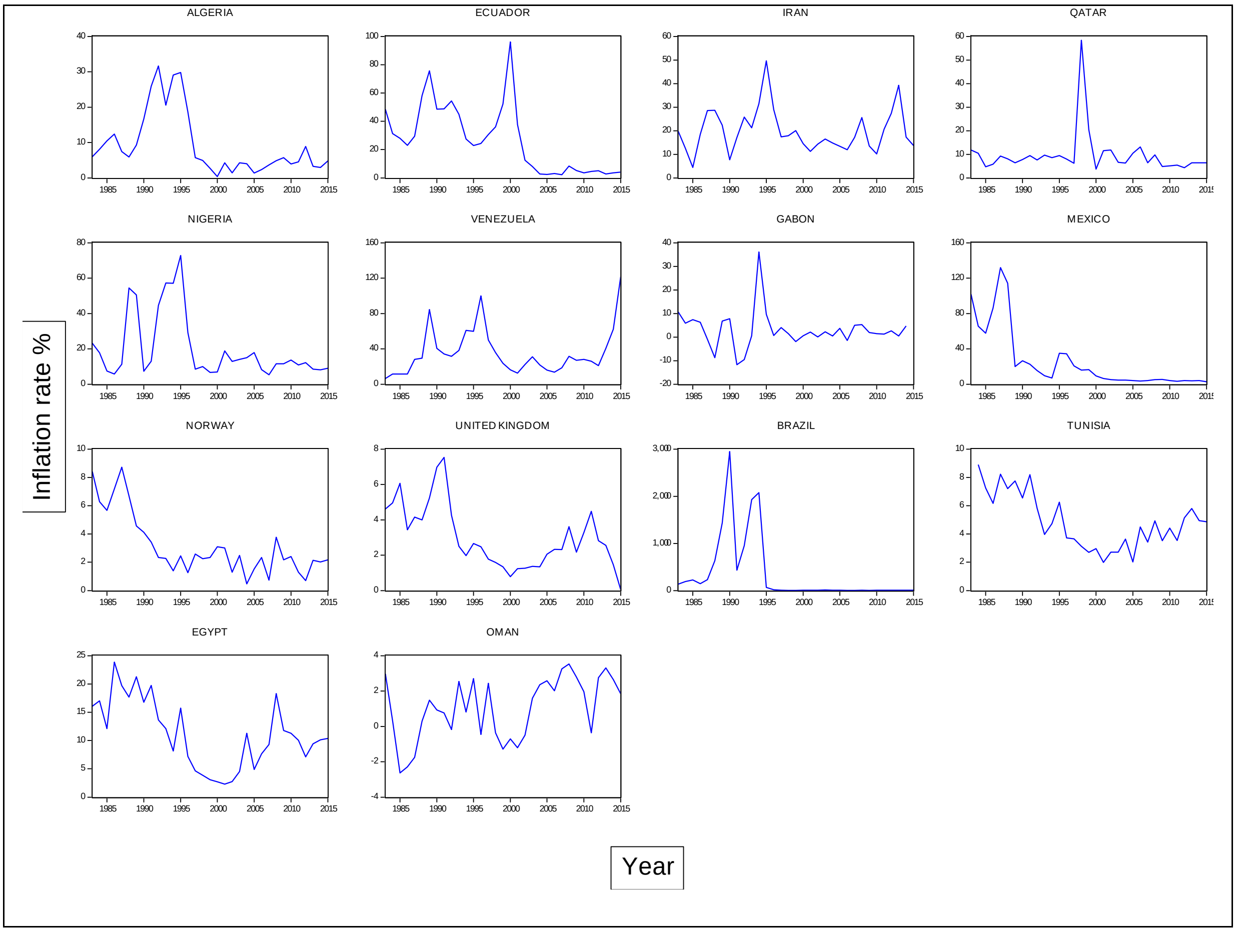


C. Inflation

In economic literature, cost-push inflation, rent seeking behaviour and Dutch disease in oil exporting countries is one of the most important channels for oil price changes affecting inflation in these states (Gylfason 1984; Algebrin 2006). There is also evidences that inflation might cause government revenue to fall and budget deficits to rise due to the tax effect, and the pursuing monetization could lead to even higher rates of inflation (Alavirad 2003).

Fig. 4.16 shows the inflation rate in OPEC and non-OPEC countries. Accordingly, the inflation is steady in OPEC countries, while only Brazil's inflation increased sharply in non-OPEC countries. Therefore, through the 1980s and 1990s, the Brazilian economy suffered from rampant inflation that subdued economic growth. After several failed economic initiatives created by the government, in 1994 the Plano Real was introduced. This plan brought stability and enabled Brazil to sustain economic growth over that of the global economy through the coming decade. Despite this rapid development the country still suffers from high levels of corruption, violent crime, functional illiteracy and poverty.

Figure 4.16. Inflation rate in OPEC and non-OPEC countries



4.4.2 Preliminary data analysis

4.4.2.1 Descriptive statistics

In the previous sections, the differences between the two groups of OPEC and non-OPEC countries were reviewed. Table 4.4 reports the full descriptive statistics of the series previously introduced. It contains the means, minimums, maximums, standard deviations, skewness, Kurtosis and J-B for the oil price volatility (OilV) oil rent volatility (OilrentsV), oil revenue volatility (OilrevenueV), GDP growth rate (R_GDP), growth rate of real exchange rate (R_EXCH), inflation consumer price index (INF), the government spending (GOV_EXP), education spending (Education_EXP), military spending (Military_EXP), and health spending (Health_EXP) in OPEC and non-OPEC countries.

Some fact can be revealed from Table 4.4:

1. All data has non-normal distribution and also has significant variability around the mean value.
2. There is no statistically significant difference between the two groups of countries in oil price volatility.
3. The means of oil revenue volatility between the two groups of countries is not statistically significant, but the difference in variance of oil revenue volatility in the two groups of the country cannot be rejected. Since the standard deviation of the oil revenue volatility in the non-OPEC group is larger, this result suggests that the variation of oil revenue volatility in this group is more than in OPEC countries, and as a result, these countries face higher risk.
4. There is no statistically significant difference between the two groups of countries in oil rents volatility. Compared to the two previous proxies, oil rent volatility is smaller but more variable than oil revenue volatility for both groups of countries.
5. The means of economic growth between the two groups of countries is not statistically significant, but the difference in variance in the two groups cannot be rejected. Since the standard deviation of economic growth in the OPEC group is larger, this result suggests that their economic growth fluctuation is more than non-OPEC countries.
6. The means of exchange rate growth between the two groups of countries is not statistically significant, but the difference in variance in the two groups of the country cannot be rejected. As we can see, the standard deviation of Exchange rate growth in non-OPEC group is higher than OPEC members.
7. The means and variance of inflation between the two groups of countries is significantly significant with OPEC members has facing higher inflation rates and increased volatility.

Table 4.4. Descriptive statistics of the variables under examination. The sample period runs from 1983 to 2015

	Mean	**Minimum**	**Maximum**	**Std. Dev.**	**Skewness**	**Kurtosis**	**J-B**	**Obs.**
OPEC countries (N=7)								
OilV	1.2352	0.3120	2.9023	0.4808	0.6521	3.5293	19.0699*	231
OilrevenueV	0.1012	0.0010	0.6931	0.0913	1.9995	10.4696	670.0056*	224
OilrentsV	0.1328	0.0001	0.5162	0.1185	1.3193	4.0877	73.9826*	218
GOV_EXP	14.2910	4.8332	35.8644	5.5954	1.4234	5.7544	151.0299*	231
INF	17.7792	-11.6861	121.7381	19.3660	2.0922	8.7329	482.7665*	230
R_EXCH	13.9290	-26.0286	296.2173	30.7322	4.6570	36.3019	11160.49*	224
R_GDP	1.0924	-21.5652	26.4993	5.0569	-0.5521	7.9475	238.7704*	223
Education_EXP	3.9215	0.0748	35.3276	3.0899	5.8807	54.4810	26840.46*	231
Military_EXP	2.7802	0.4147	13.7858	2.4050	2.2911	9.0154	550.3684*	231
Health_EXP	4.1492	0.3941	11.6386	1.6534	0.7741	5.0047	61.7491*	231
Non-OPEC countries (N=7)								
OilV	1.1859	0.3119	2.9472	0.5358	0.7849	3.1321	23.8874*	231
OilrevenueV	0.1050	0.0004	1.0098	0.1187	3.8218	26.1004	5525.859*	224
OilrentsV	0.1368	5.35E-05	0.6822	0.1319	1.7175	6.2594	209.2864*	224
GOV_EXP	16.497	8.2685	27.2196	4.1065	-0.2265	2.1106	9.5885*	231
INF	57.1410	-2.6359	2947.733	293.7074	7.3333	60.7088	33977.29*	230
R_EXCH	14.1722	-18.3639	318.2256	47.4978	4.5001	24.4693	5058.088*	224
R_GDP	1.5636	-7.8275	9.6606	2.5618	-0.7312	4.8042	50.3455*	224
Education_EXP	4.8129	2.2113	7.8325	1.2997	0.1046	2.5218	2.6224*	231
Military_EXP	2.4687	0.4062	9.1899	1.6109	1.4373	5.8548	157.9833*	231
Health_EXP	6.6310	2.1502	20.4370	2.8429	1.7404	8.3939	396.6527*	231

Note: * denotes significance at the 1% level. J-B denotes the Jarque-Bera test for normality.

4.4.2.2 Panel unit root test results

According to the LLC and the IPS unit root tests-statistics, all variables are stationary, indicating the appropriateness of using PVAR analysis.

Table 4.5. Panel unit root test results

Variables	H_0: All panels contain unit root			
	LLC		**IPS**	
OPEC Countries				
OilV	-9.4525***	[0.0000]	-9.0926***	[0.0000]
OilrevenueV	-2.7151***	[0.0033]	-5.2509***	[0.0000]
OilrentsV	-1.6381***	[0.0507]	-4.5556***	[0.0000]
GOV_EXP	-1.4785***	[0.0307]	-2.0573***	[0.0198]
INF	2.3824***	[0.0086]	-1.5440***	[0.0613]
R_EXCH	-3.6867***	[0.0001]	-8.7549***	[0.0000]
R_GDP	-4.8117***	[0.0000]	-5.1158***	[0.0000]
Education_EXP	-5.1232***	[0.0000]	-4.4186***	[0.0000]
Military_EXP	-4.5285***	[0.0000]	-6.9173***	[0.0000]
Health_EXP	-4.8018***	[0.0000]	-8.7721	[0.0000]
Non-OPEC Countries				
OilV	-10.0226***	[0.0000]	-8.8608***	[0.0000]
OilrentsV	-4.7636***	[0.0000]	-5.8374***	[0.0000]
OilrevenueV	-5.7066***	[0.0000]	-6.5254***	[0.0000]
GOV_EXP	-3.1014***	[0.0010]	-1.7432***	[0.0406]
INF	-2.3824***	[0.0086]	-1.5440***	[0.0613]
R_EXCH	-4.8732***	[0.0000]	-5.5444***	[0.0000]
R_GDP	-4.0209***	[0.0000]	-5.0349***	[0.0000]
Education_EXP	-1.8880***	[0.0295]	-1.4474***	[0.0739]
Military_EXP	-3.8646***	[0.0001]	-1.9584***	[0.0251]
Health_EXP	-4.2696***	[0.0000]	-7.5730***	[0.0000]

The numbers in brackets denote *p*-values. The LLC test is performed using the Newey–West bandwidth selection with Barlett Kernel, and the Schwartz Bayesian Criterion is used to determine to optimal lag length.* Indicate rejection of the null hypothesis at the 1% levels of significance, respectively.** Indicate rejection of the null hypothesis at the 5% levels of significance, respectively.*** Indicate rejection of the null hypothesis at the 10% levels of significance, respectively.

4.4.2.3 Panel Granger causality test results

We begin our analysis by focusing on panel Granger causality tests, discussed above, among OPEC and non-OPEC countries. Results are given by Tables 4.6 and 4.7. Also, the results for the sub-categories of government expenditure are qualitatively similar and the actual results are in Appendixes A.15 -A.26.

Firstly, Table 4.6 indicates that all of the oil volatility proxy's granger cause government expenditures and other macroeconomic variables in OPEC and non-OPEC countries.

Secondly, in Table 4.7, Granger causality test of economic growth, exchange rate growth and inflation to government spending is reported. As can be observed, the three macroeconomic variables granger cause government spending in both groups of countries.

Thus, it can be argued that past values of oil volatility proxies contribute to the prediction of the present value of all macroeconomic variables of this research even with past values of theirs. Also, economic growth, exchange rate growth and inflation contribute to the prediction of the present value of government spending.

Additionally, the finding of the granger causality test suggests which of the variables in the models have statistically significant impacts on the future values of other variables in the system (Rafiq et al. 2009). However, the result will not, by construction, be able to explain the sign of the relationship or how long these impacts will remain effective in the future. Impulse response functions give this information (Rafiq et al. 2009; Antonakakis et al. 2017a; Antonakakis et al. 2017b)

Table 4.6. Granger causality tests among oil volatility proxies and other macroeconomic variables

	Dependent variable			
	GOV_EXP	**INF**	**R_EXCH**	**R_GDP**
OPEC Countries				
OilV	5.4953*	4.4951*	8.3897*	5.7601*
OilrevenueV	7.1456*	5.3732*	4.1633*	4.8201*
OilrentsV	5.5424*	4.2464*	5.7088*	4.5412*
Non-OPEC Countries				
OilV	6.3401*	5.1144*	5.0647*	4.1550*
OilrevenueV	4.5643*	4.0558*	6.2343*	5.0194*
OilrentsV	10.7708*	5.6534*	5.2544*	4.6277*

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. * denotes significance at the 5% level.

Table 4.7. Granger causality tests among government spending and other macroeconomic variables

Dependent variable	**INF**	**R_EXCH**	**R_GDP**
OPEC Countries **GOV_EXP**	4.6567*	7.54481*	4.6543*
Non-OPEC Countries **GOV_EXP**	4.7127*	5.6438*	8.0416*

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. * denotes significance at the 5% level.

4.5 Level of democracy data

In the oil-exporting countries there are both democratic countries and those with limited or no democracy. This implies a question whether oil volatility's impact on government expenditure is influenced by the level of democracy? The answer to this question is another objective of this study.

Due to the unavailability of data for all sample countries in the period 1983-2015, we have an unbalanced panel of annual data from 14 countries. The countries included in our dataset are listed in Table 4.14. The data used in this section are collected from the Polity IV project. The democracies and non-democracies are then computed as the Polity IV average over the sample period, values that range between +6 and +10 reflect democracies, and those countries with an average value between -10 and +5 are regarded as non-democracies (see Table 4.9 for a detailed description of our dataset and their sources).

Table 4.8. Countries included in the sample- Panel A: Level of democracy

Democracies	Non-Democracies
Norway	Algeria
United Kingdom	Iran
Brazil	Qatar
Ecuador	Nigeria
Venezuela	Gabon
	Mexico
	Tunisia
	Egypt
	Oman

Table 4.9. Variable description and sources

Name	Description	Source	Notes
Democracy status	Dummy variable (0 for democracies and 1 for non-democracies)	Polity IV project	Countries are classified according to the Polity IV index in democracies (Polity IV scores between 6 and 10), and anocracies/ autocracies (Polity IV scores between −10 and 5)
Xrreg	Rating based on a 1–3 scale	Polity IV project	It is a component of the Polity IV index, and measures the "Regulation of Chief Executive Recruitment" mechanism
CROSS_1_i i=1,2,3	Interaction term	-	Calculated as the product of democracy status and oil volatility 1: oil price volatility 2: oil revenue volatility 3: oil rent volatility
CROSS_2_i i=1,2,3	Interaction term	-	Calculated as the product of Xrreg, democracy status and oil volatility 1: oil price volatility 2: oil revenue volatility 3: oil rent volatility

Note: Annual data14 countries for the period 1983-2015.

Following empirically related studies on natural resources that also use panel models (see, for example, Bhattacharyya and Hodler 2010; Boyce and Emery 2011; Cavalcanti et al. 2011; Bjorvatn et al. 2012, among others), we propose different specifications of PVAR models.

4.5.1 Quality of political institutions

The Polity IV index is a commonly used proxy for institutional quality in several studies (see, for example Bhattacharyya and Hodler 2010; Arezki and Brückner 2011; Bjorvatn et al. 2012; Brückner et al. 2012; El Anshasy and Katsaiti 2013; Boschini et al. 2013; Caselli and Tesei 2016; Antonakakis et al. 2017). The index allocates annual scores to each country, ranging from −10 to +10. According to the Polity IV index, values that range between +6 and +10 reflect democracies, with those countries scoring between +6 to +9 are identified as flawed democracies, and those countries with a score of +10 are regarded as full democracies. On the other hand, a score between −5 and +5 is allocated to these countries which are regarded as anocracies, whereas a score between −10 and −6 is given to autocratic regimes.

4.5.2 Interaction terms

When an independent variable has a different effect on the outcome depending on the values of another independent variable, an interaction occurs. In this situation adding interaction terms to a regression model can greatly expand understanding of the relationships among the variables in the model and allows more hypotheses to be tested. Therefore, we further use an interaction term between the oil volatility and constraints to the executives, so as to account for the interdependencies among the quality of political institutions, government spending, sub-categories of government spending and oil dependent volatility. More specifically, we use an interaction term between oil dependent volatility and the 'Regulation of Chief Executive Recruitment' (CROSS_1_i; as defined in Table 4.9), which allows the distinction between democratic and non-democratic classification. The Polity IV project also provides a score for the extent to which institutionalised procedures are put in place for transferring executive power (i.e. degree of the constraints to the executives) and which is abbreviated as XRREG. The score ranges between 1 to 3, with 1 denoting no constraint to the executives (i.e. self-selection by seizure of power), 2 denoting a transition stage (i.e. informal competition with an elite group or restricted elections) and 3 denoting constraints to the executives (i.e. via birthright, competitive election, dual executives where ascriptive and designated rulers coexist). Based on the XRREG we will create another interaction tem (CROSS_2_i; as defined in Table 4.9) to assess whether the constraints to the executives play a role in the transmission mechanism between oil volatility and government spending.

In Table 4.10, we present the panel unit root test of interactive term variable for the democratic and non-democratic countries. According to the panel unit root test, all variables are stationary, indicating the appropriateness of using PVAR analysis (see Table 4.10).

Table 4.10. Panel unit root test results

Variables	H0: All panels contain unit root			
	LLC		**IPS**	
Democratic countries				
CROSS_1_1 (OilV_aut0dem1)	-8.1153***	[0.0000]	-7.1623***	[0.0000]
CROSS_1_2 (OilrevenueV_aut0dem1)	-2.4719***	[0.0067]	-4.0370***	[0.0000]
CROSS_1_3 (OilrentsV_aut0dem1)	-2.0833***	[0.0186]	-3.5498***	[0.0002]
CROSS_2_1 (OilV_aut0dem1xrreg)	-7.4033***	[0.0000]	-6.9342***	[0.0000]
CROSS _2_2 (OilrevenueV_aut0dem1xrreg)	-1.5371***	[0.0000]	-4.0356***	[0.0000]
CROSS_2_3 (OilrentsV_aut0dem1xrreg)	-2.0122***	[0.0221]	-3.5560***	[0.0002]
Non- democratic countries				
CROSS_1_1 (OilV_aut1dem0)	-11.1507***	[0.0000]	-10.495***	[0.0000]
CROSS_1_2 (OilrevenueV_aut1dem0)	-5.4276***	[0.0000]	-7.3325***	[0.0000]
CROSS_1_3 (OilrentsV_aut1dem0)	-3.9465***	[0.0000]	-6.4134***	[0.0000]
CROSS_2_1 (OilV_aut1dem0xrreg)	-8.4328	[0.0000]	-8.4642	[0.0000]
CROSS_2_2 (OilrevenueV_aut1dem0xrreg)	-4.7287	[0.0000]	-6.5908	[0.0000]
CROSS_2_3 (OilrentsV_aut1dem0xrreg)	-2.6481	[0.0040]	-5.7225	[0.0000]

The numbers in brackets denote *p*-values. The LLC test is performed using the Newey–West bandwidth selection with Barlett Kernel, and the Schwartz Bayesian Criterion is used to determine to optimal lag length.* Indicate rejection of the null hypothesis at the 1% levels of significance, respectively.** Indicate rejection of the null hypothesis at the 5% levels of significance, respectively.*** Indicate rejection of the null hypothesis at the 10% levels of significance, respectively.

The results show that there is evidence of granger-causality from the interactive term variables to the four macroeconomic variables (i.e, GOV_EXP, INF, R_EXCH and R_GDP). Therefore, oil volatilities based on the quality of political institutions of countries is a granger cause of macroeconomic variables, in particular government expenditure. In addition, the Granger-causality results for the sub-categories of government expenditure are qualitatively similar and the actual results are in Appendices A.27- A.50.

Table 4.11. Granger causality tests among the CROSS terms' variables and macroeconomic variables

Excluded	Dependent variable			
	GOV_EXP	**INF**	**R_EXCH**	**R_GDP**
Democratic countries				
CROSS _1_1	4.3454*	5.8166*	5.4151*	9.4317*
CROSS _1_2	7.0312*	5.9447*	4.9548*	5.3427*
CROSS _1_3	4.0296*	8.1625*	3.9634*	4.3527*
CROSS _2_1	6.4026*	7.8759*	5.8045*	4.4234*
CROSS _2_2	9.0081*	4.2379*	6.1837*	8.4435*
CROSS _2_3	5.0093*	4.2426*	4.4853*	4.4295*
Non- democratic countries				
CROSS _1_1	6.5702*	6.8142*	7.8465*	7.5284*
CROSS _1_2	5.3801*	7.1281*	5.1814*	6.4547*
CROSS _1_3	5.8263*	8.2469*	5.3471*	6.0428*
CROSS _2_1	4.4033*	5.7146*	5.3113*	5.0886*
CROSS _2_2	4.1282*	5.1106*	5.0384*	4.2327*
CROSS _2_3	4.9721*	4.1915*	4.9335*	4.1796*

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *denotes significance at the 5% level.

4.6 Conclusion

This chapter has described the oil dependent volatility variables that are used throughout the study and explained why these variables were chosen. Therefore, we have presented three proxies of oil volatility: oil prices, oil rents and oil revenues volatility in the OPEC and non-OPEC countries and explained how they are measured and estimated. Additionally, the macroeconomic data, the level of democracy and their preliminary data analysis have been explained in this chapter. In the next chapter, the first empirical results, entitled “empirical studies on oil volatility and aggregated government expenditure” is presented.

Chapter 5- Empirical Studies on Oil Volatility and Aggregated Government Expenditure

5.1 Introduction

In this chapter, the direct and indirect effect of the oil volatility on aggregated government spending is investigated. This study focuses on a group of oil-exporting countries, which comprises of both OPEC and non-OPEC countries, and examines whether oil price volatility, oil rent volatility and oil revenue volatility exercises an impact on the fiscal side of these economies. To achieve this aim, we apply a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions over the period 1983-2015. To capture the full dynamics of the aforementioned relationship in a PVAR setting, it also considers core macro-economic variables, namely GPD per capita growth rate, inflation rate and exchange rates growth.

As shown in the review of the related literature (see Chapter 2), it is worth reiterating that very little work has been done with respect to the effects of oil uncertainty (approximated by oil price volatility, oil rent volatility and oil revenue volatility) on aggregated government expenditure for oil exporting countries. At the same time most papers, including those by Rutten (2001), Selmi et al. (2012), Oriakhi and Osaze (2013) and Alley (2016), usually examine the effect of oil price including shocks, changes, rents and revenue (oil dependence) on the macroeconomic aggregates and not on aggregated government spending. It is believed that, this is the first research study that adopts a panel VAR approach, and a panel impulse response analysis, to study the dynamic impact of oil price volatility, rent volatility and revenue volatility on aggregated government spending by taking into account the endogeneity of these variables.

As already shown in Chapter 4, the PVAR model is estimated using the following variables, oil price volatility proxies (OilV, OilrentsV, OilrevenueV), aggregate government spending (GOV_EXP), inflation (INF), exchange rates (R_EXCH), and economic growth per capita (R_GDP). In Chapter 4, this study established that the variables are stationary, and, thus, the study can now proceed with the analysis of the PVAR model and its impulse responses, concentrating on the direct and indirect effects of the oil volatility proxies and general government expenditure.

5.2 Panel generalised impulse response functions: full sample analysis

This section will present the empirical evidence for the panel generalised impulse response functions, as discussed, based on the estimation of Eq. (3.1), with a lag order of 4, determined by the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). Therefore, it will calculate the generalised panel impulse response functions tracing out the reaction of government spending (of OPEC and non-OPEC countries) on shocks to oil volatility, which could be direct or indirect via the other macroeconomic variables.

5.2.1 OPEC countries analysis

The discussion begins with analysis of the impulse response based on the OPEC analysis. The results are shown in Figs. 5.1, 5.2 and 5.3 for the oil price volatility (OilV), oil rent volatility (OilrentsV) and oil revenue volatility (OilrevenueV), respectively.

5.2.1.1 Oil price volatility

Reference to Figure 5.1 shows that OilV does not exert any significant direct or indirect effect on GOV_EXP of the OPEC countries (see PGIRFs of Appendix B.1). A plausible explanation is that the OilV measure may not be able to capture the potential effects on economic growth or investments in the OPEC countries. The OilV variable captures only price uncertainty, which does not necessarily translate into oil income uncertainty. Thus, solely considering oil price movements may not reveal the effects on government expenditure. This could be due to the fact that despite oil price uncertainty, oil importing countries still demand oil, which translates to revenue for oil-exporters.

OPEC countries coordinate and unify the petroleum policies of its member countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital for those investing in the petroleum industry. Another plausible explanation is the fact that the OPEC countries are a price makers' cartel, and therefore oil price volatility may not engender any surprises and thus has no impact on their macroeconomic fundamentals, and as a result, member countries will not be affected by volatilities in oil prices like other countries.

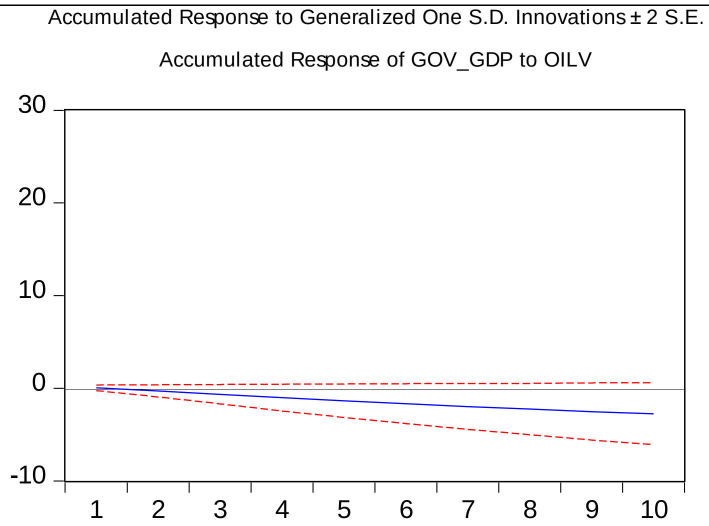
Compared to the results of this section, Iwayemi and Fowowe (2011) find that oil price shocks do not have a major impact on most macroeconomic variables in Nigeria. They believe this result is due to a large proportion of foreign exchange earnings being spent on importation of consumer durables. Adedokun (2018) reports that oil price shocks could not predict the variation in Nigeria's government expenditure in the short-run.

Cunado and De Gracia (2005) argue against the use of oil price as an impulse variable in the study of the nexus between the oil price shocks and macroeconomic variables. It should be noted, however, that these papers have focused on oil price shocks, not volatility.

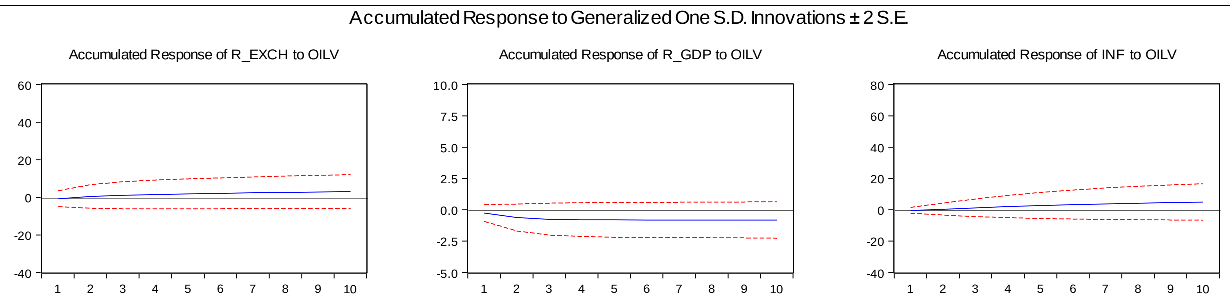
Dizaji (2014) also indicates that the ability of oil revenue to explain the shock to government expenditure as a percentage of GDP is superior to the use of oil price shocks. The next section is focused on oil revenue volatility impacts.

Figure 5.1. Cumulative generalised impulse responses of oil price volatility in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, GOV_EXP= government spending

5.2.1.2 Oil revenue volatility

The direct and indirect results of oil revenue volatility and the effect on aggregated government expenditure are reported in Figure 5.2 (see PGIRFs of Appendix B.2). The results suggest that OilrevenueV exercises a direct positive effect on GOV_EXP, suggesting that when oil revenue uncertainty increases this leads to higher government expenditure (as a percentage of GDP).

There are some possible explanations for this. First, it could mean that government expenditure expands as a result of higher oil revenue volatility so that OPEC countries can protect their economies during periods of uncertain revenue streams from the oil exports. This could be potentially linked with Keynesian counter-cyclical policies. Second, this can be attributed to the creation of reserve funds, which many oil-exporting countries apply to accumulate oil revenues. These funds allow oil-exporting countries to secure themselves, to some extent, against negative shocks of their oil revenues. Additionally, in the event of a decline in oil revenues, economic stagnation, budget deficit, and similar problems, the resources of this fund are applied to mitigate any shocks, to support fiscal policies and even a limited expansionary phase. As a result, these resources can be used in a period of uncertainty in oil revenues to finance an expansionary budget to mitigate any problems that arise from oil uncertainty. The outcome of such a process may be a positive reaction of government expenditure (as a percentage of GDP) as an active policy to support the economy against rising oil revenue uncertainty.

Alternatively, in a period of revenue volatility it could mean that both government expenditure and GDP fall, with the latter falling at a higher rate. This might be plausible given that oil revenue volatility is expected to exercise an impact on other components of GDP (i.e. net exports, investments and possibly consumption), rather than just government expenditure.

This situation may be true for OPEC countries which are mainly developing countries with economies that are controlled by government decree. In the event of oil revenue volatility these countries tend to display a negative correlation between current and capital expenditure with the latter having a propensity to decline (Mattina and Gunnarsson, 2007). Therefore, in the event of oil revenue shocks, the reduction in capital expenditures would be greater than that of current expenditure.

Oil price volatility is an outcome of exogenous shocks transmitted to the economies of oil exporting countries and since oil revenues accrue to governments, the outcome will determine fiscal policies. The revenues affect the economy through government spending decisions. However, optimal decisions on current government expenditures take into consideration information about current and future revenues.

According to the results in Fig. 5.2, it is observed that the inflation response to a standard deviation of oil volatility shock is positive, so it can be noted that economic agents moderate their inflation expectation upwards in response to oil revenues uncertainty. The reason for this response may be that with the increase of uncertainty in oil revenue which is the main source of government financing in OPEC countries, economic agents expect that the government can finance the budget deficit through borrowing from the central bank, and this will result in a rise in the monetary base and inflation. Also, it is noticeable that the response to government expenditure to a positive inflation shock is negative. Thus, an increase in oil revenue uncertainty associated with increased inflation through the inflation channel results in a decrease in government expenditure (as a percentage of GDP). Although it is expected that increasing inflation raises government expenditure. However, it must be noted that if the elasticity price index implicit alongside other components of GNI, such as investment and private consumption, is greater than one, it is not anticipated that increasing inflation reduces government expenditure as a percentage of both GNI and GDP (consumer price index growth).

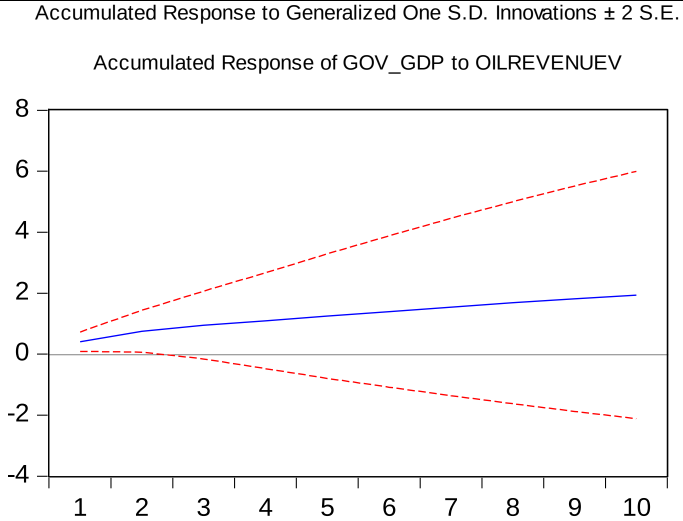
Another indirect impact of oil revenue uncertainty on government expenditure (as a percentage of GDP) is seen in Fig. 5.2 which is a channel of GDP or revenue impact. Since oil revenues are the main source of financing part of the state budget in most of the oil exporting countries, oil revenue volatility will have an adverse impact on economic growth through uncertainty toward the demand of the economy (Bartsch et al. 2004). The research of De V. Cavalcanti et al. (2015) show that the volatility in prices is that supply creates the paradox of the resource curse (according to Frankel (2010): crowding out of manufacturing, civil war, poor institutions, and the Dutch Disease) not just the abundance of resources. Mohaddes and Pesaran (2013) find that the negative relationship between oil revenue volatility and economic growth in Iran. They suggest that the lack of appropriate political arrangements, the institutions of rents and the lack of development of money and capital markets, are the cause of the negative effect of oil revenue volatility on economic growth. The resulting oil revenue uncertainty is accompanied by the decline in GDP in the OPEC countries. Then, a decline in GDP (as a result of which there is a positive correlation with the share of government expenditure as a percentage of GDP), leads to a reduction in government expenditure as a percentage of GDP. As a result, the income effect of oil revenue uncertainty on the share of government expenditure as a percentage of GDP is negative. The uncertainty of oil revenue decreases the tax base by reducing revenue and can oblige the government to reduce its expenditure.

As OPEC countries' governments are fiscally dependent on natural resource revenue, the composition of fiscal adjustments matters to long-term growth.

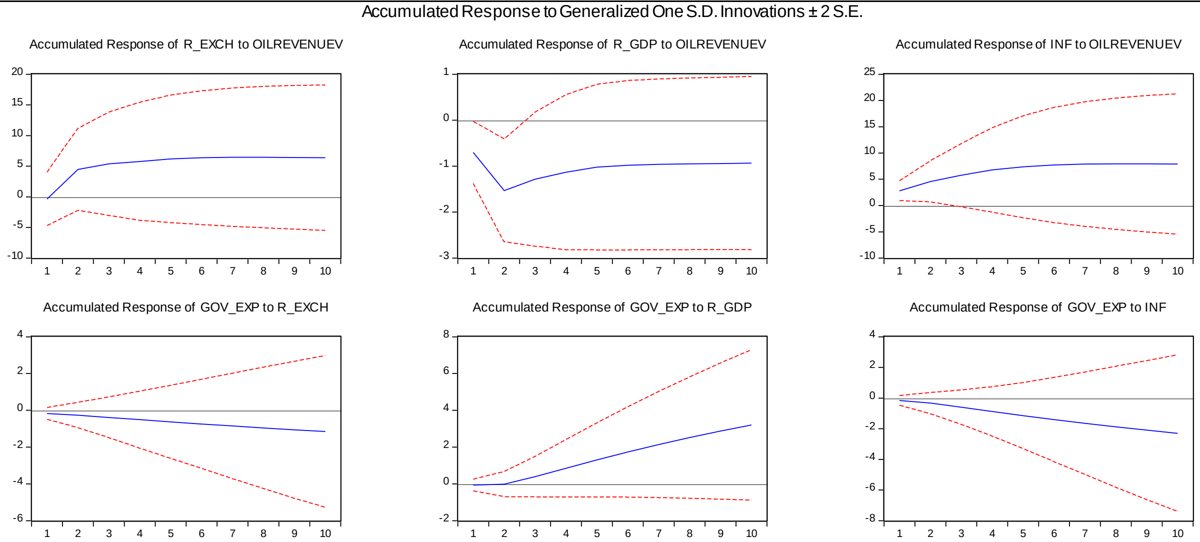
Our findings complement the findings by Hamdi and Sbia (2013), Dizaji (2014), Eltony and Al-Awadi (2001) and Adedokun (2018) who suggest that oil revenue has a significant positive effect on government spending in oil exporting countries, but they use actual values of government spending rather than government expenditure as a percentage of GDP.

Figure 5.2. Cumulative generalised impulse responses of oil revenue volatility in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, GOV_EXP= government spending

5.2.1.3 Oil rent volatility

In this part of the study, we will examine the impact of oil rent volatility on government expenditure in OPEC countries (see PGIRFs of Appendix B.3). Oil rents are the difference between the value of crude oil production and production costs which will be a more accurate indication compared to oil revenues. This variable is used, for example, in the study of Sachs and Warner (2001) Farzanegan (2011) to illustrate the importance of oil within relevant economies.

In Fig. 5.3, the results show that the direct impact of OilrentsV shock on GOV_EXP is positive in the short-term in OPEC countries and thereafter fails to exert any significant direct effect, however, the impact of the oil revenues volatility is significant across a greater time frame. This difference in the impact of oil rent and oil revenue volatility is rooted in production costs, which is included in the oil rents index. When OPEC countries are confronted with uncertainty in oil revenues, this is mainly due to the effect of two factors, exports (demand from importing countries) and oil prices. However, oil rent uncertainty is related to domestic oil production costs and is therefore oil rents are more influenced by domestic economic factors than oil revenue (Farzanegan 2011), since oil rents are more controlled by the domestic economy, we expect oil rents uncertainty to have a more temporary effect compared with oil revenue uncertainty.

Moreover, the impact of oil rent volatility on other variables indicate that a positive shock to OilrentsV has positive effects on the R_EXCH and INF and a negative impact on R_GDP. The uncertainty of oil rents directly affects the country's oil industry and its added value to the domestic economy. As a result, the uncertainty of oil rents leads to a decline in economic growth. However, the higher economic growth leads to higher government expenditures as a percentage of GDP.

Therefore, there are two indirect impacts of the oil rents volatility on government expenditures. The first effect is the exchange rate channel. According to Fig. 5.3, the higher OilrentsV lead to higher R_EXCH in the OPEC countries, which means a depreciation of their national currency. This result is also obtained in the study of Jiranyakul (2015), and Ghosh (2011). These countries have an oil-based, single-product economy, and oil export is an important component of their trade-off. With the growth of oil rent volatility, the trade-off of OPEC countries is fluctuating with a consequent effect on the exchange rate. It is also observed that the response of inflation is positive to any increase in oil rent volatility.

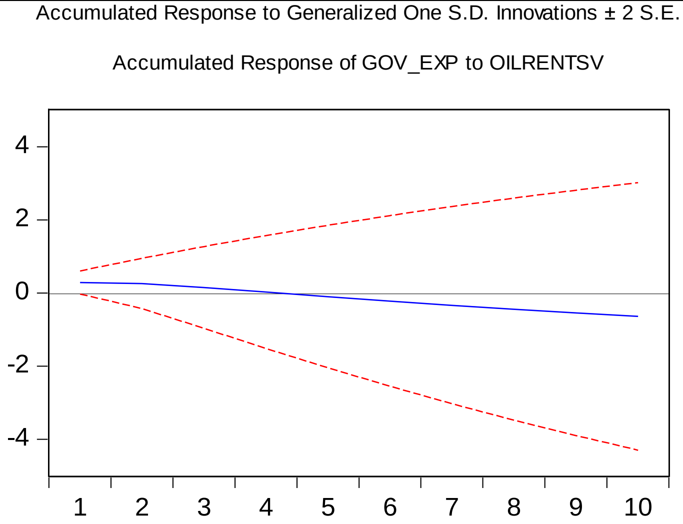
As a result, any possibility of a change in the economic situation and an increased risk in OPEC countries can lead to an increase in the dollar's value in these economies as a result of currency depreciation. With increasing oil price uncertainty and the risk in the domestic economy, the exchange rate will increase. In these countries, economic growth has also declined in response to uncertainty in oil prices. Consequently, the exchange rate will eventually increase. The appreciation of the dollar can now lead to a reduction in government expenditure, as shown in Fig. 5.3. The devaluation of the domestic currency is reduced imports with the assumption of stability in other conditions. Therefore, import reductions lead to an increase in gross national income (GNI). On the other hand, the appreciation of the dollar may increase the value of non-oil exports and even increase the value of oil exports (in domestic currency), which further increase net exports and may increase the net export share in the national accounting system. Since the increase in the share of a component of the national accounting convention should be accompanied by a reduction in the share of other components, as a result, a reduction in the share of government expenditure can occur, as seen in Fig. 5.3.

Moreover, we further observe that the indirect effects of an OilrentsV shock to GOV_EXP, via the inflation channel, has a similar effect as oil revenue volatility on government expenditure in this sector. The higher uncertainty in oil revenues, which is accompanied by rising inflation due to rising inflationary expectations, reduces the share of government expenditure as a percentage of GDP through the inflation channel (possibly general level of prices rises more than nominal value of government expenditures). With an increasing dollar value against the domestic currency and the decline in economic growth as a result of increased oil rents volatility, this provides evidence on the accuracy of the mechanisms as described earlier in this section.

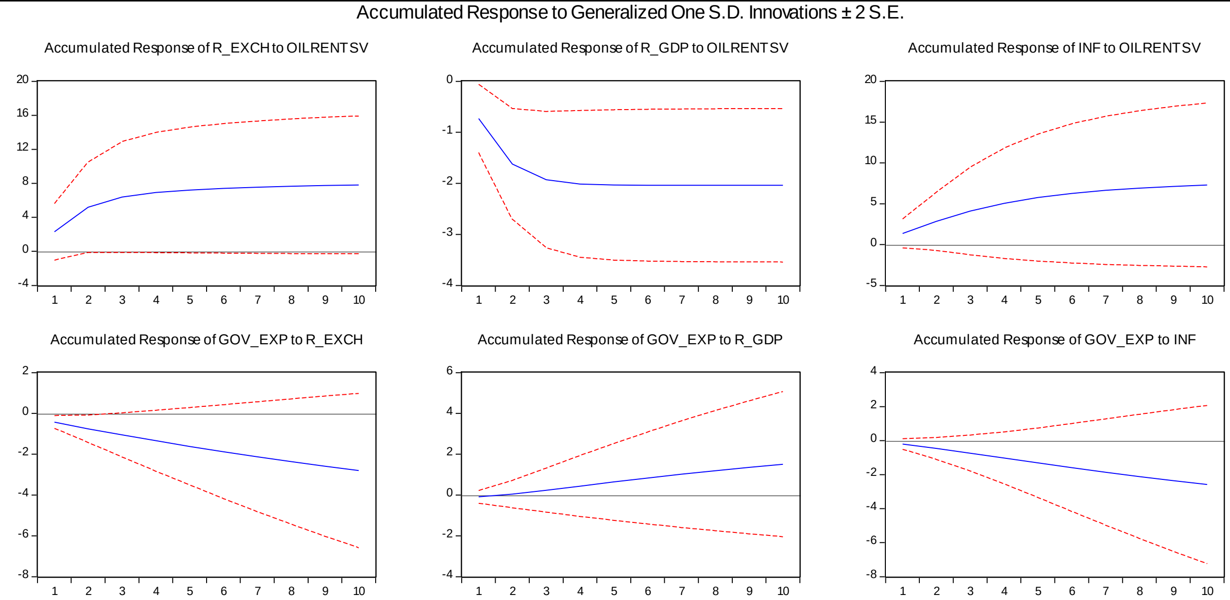
The results are similar to those of Farzanegan et al. (2017) and Farzanegan (2011). However, Farzanegan (2011) finds different impacts of oil rents on government expenditures in Iran, which is the focus of this research in the following chapter.

Figure 5.3. Cumulative generalised impulse responses of oil rents volatility in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, GOV_EXP= government spending

5.2.2 Non-OPEC countries analysis

5.2.2.1 Oil price volatility

In Fig. 5.4, the impact of a standard deviation of a positive shock to oil price volatility has been shown in non-OPEC countries (see PGIRFs of Appendix B.4). The first point is that OilV exercises a direct positive effect, although marginally, to the GOV_EXP of the non-OPEC countries, which was not significant in OPEC countries. Since oil price volatility has only market-related uncertainty and does not depend on the internal characteristics of the countries, therefore, possibly we could say that since non-OPEC countries are not members of an oil cartel like OPEC countries, so these are more likely to be affected by uncertainties in the global oil market.

As can be seen, the response of GOV_EXP to a positive shock of OilV is positive in non-OPEC countries. As a result of increasing uncertainty in oil prices, the share of government expenditure on their economies increases. The finding from Fig. 5.4 indicates that a higher OilV leads to a lower R_GDP in this group of countries. Since the share of government expenditure (as a percentage of GDP) increases in response to an increase in uncertainty, it can be related to the response of the fiscal authority: either the government of these countries apply an expansionary fiscal policy, in spite of a decline in economic growth, or at least, do not reduce expenditure more than GDP. This point will be further elaborated in the analysis of the indirect channels. This is a very probable hypothesis as oil-exporting countries have used the national wealth funds to save oil revenues in recent years.

As shown in Fig. 5.4, we further observe that there is an indirect channel by which OilV impacts GOV_EXP. Therefore, higher OilV leads to a decline in R_GDP in these countries. Economic literature has paid special attention to the impacts of oil shocks on economic growth. Hamilton (1983) suggests that oil price shocks have a negative impact on macroeconomic measurements and can even be a cause of recession. One of the most important components of the investment economy is that, it is heavily risk-sensitive, and economic literature shows that investment in the event of uncertainty will be delayed. Bernanke (1983a) was also among the first to show that uncertainty of oil prices would reduce investment incentives. Difeto et al. (2018) examine the impact of oil price volatility on OECD countries and conclude that oil price volatility has a more negative impact on economic growth of oil-exporting countries than oil-importing countries. Omojolaibi and Egwaikhide (2013) review the five oil-exporting countries in Africa, and they find that the oil volatility effect channel identifies economic performance as an investment. De V. Cavalcanti et al. (2015) report a negative impact of volatility on economic growth through the lower capital accumulation channel. El-Anshasy et al. (2017) also show evidence of the negative impact of volatility on economic growth through the channel of reducing total factor productivity. Hence, it seems that there is an indirect channel of oil price volatility on government expenditure, derived from the channel of gross domestic product (GDP) or income effect. The decline in economic growth will lead to an increase in the share of government expenditure as a percentage of

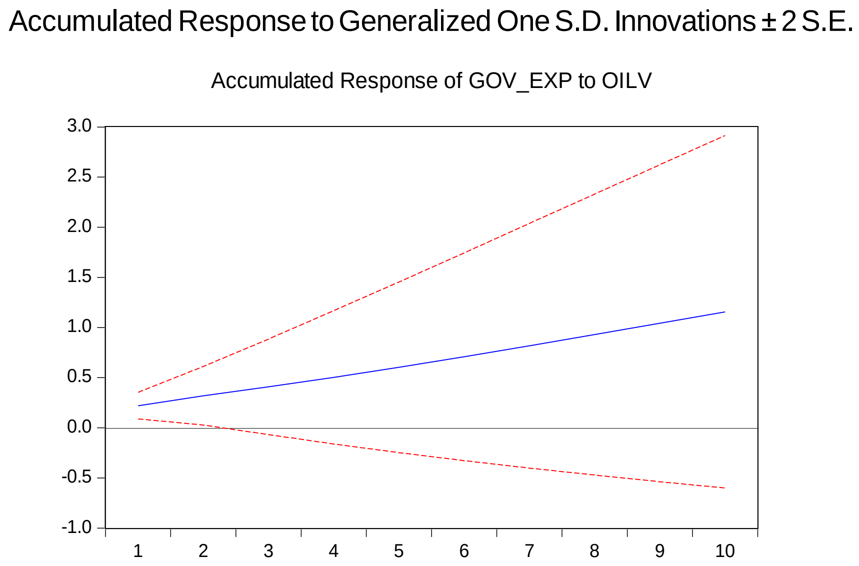
GDP in production (due to the negative response of government expenditure to economic growth in Fig. 5.4), which is in line with the earlier hypothesis that in non-OPEC countries, the government is adjusting its spending's in ways that do not reduce its share in GDP.

In addition, we further observe the indirect effects of OilV shock to GOV_EXP, via the R_EXCH and INF channels. Figure 5.4 shows that a positive shock to OilV leads to an increase in INF. Increasing inflation in response to rising uncertainty in oil price can be due to several reasons. First, by increasing the risk of oil prices to the exporting countries, the economic agents will moderate their expectations and expect more inflation. As the supply of the economy (production) is limited in response to uncertainty over the price of oil, supply is reduced. On the other hand, we can see an increase in government expenditure as a part of demand, as a result, it is likely that a part of an increase in inflation is due to increased demand.

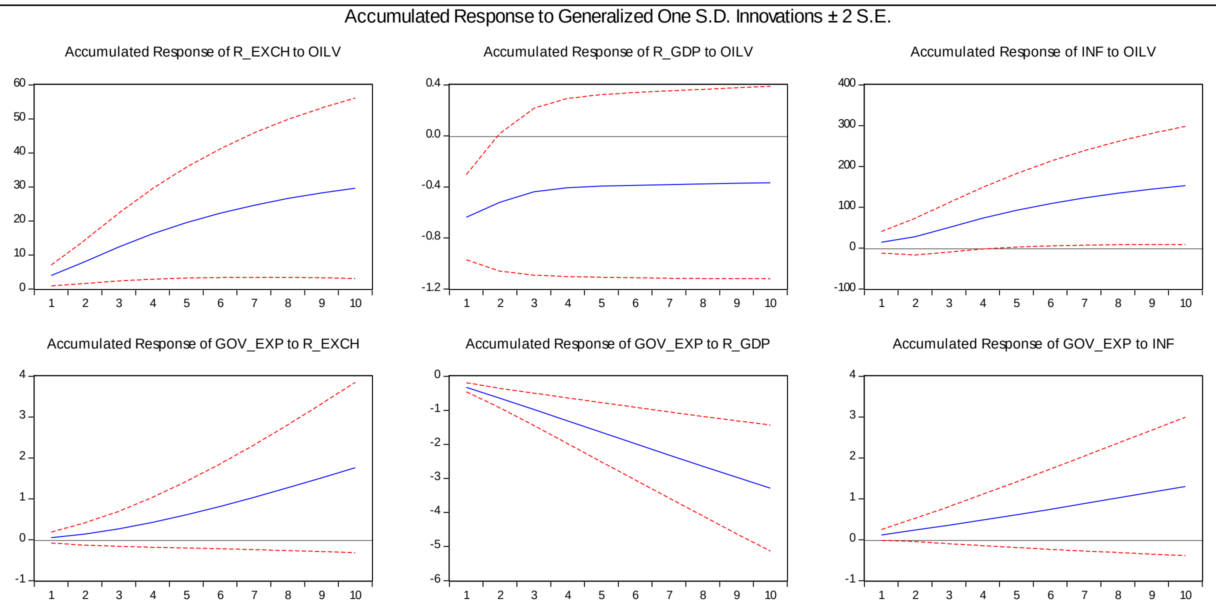
Since the R_EXCH response to higher OilV is positive, so the increase in the exchange rate will lead to an increase in inflation through inflation expectations and rising prices for imported goods. Thus, we see that rising inflation will lead to an increase in the share of government expenditure as a percentage of GDP. One of the explanations for this could be to increase government expenditure due to inflation. The government is also a consumer in the market with a demand for goods and services. If wage rates and service prices rise in relation to government purchasing, government expenditure will inevitably increase.

Figure 5.4. Cumulative generalised impulse responses of oil price volatility in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, GOV_EXP= government spending

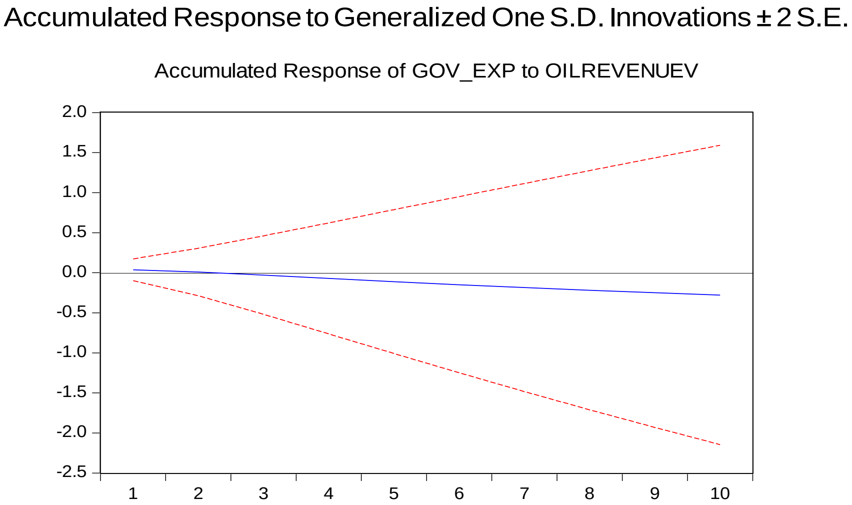
5.2.2.2 Oil revenue volatility

The results relating to GIRFs of oil revenue volatility in non-OPEC countries are presented in Fig. 5.5 (see PGIRFs of Appendix B.5). The findings from Fig. 5.5 indicate that OilrevenueV does not exert any significant direct or indirect effect on GOV_EXP of the non-OPEC countries.

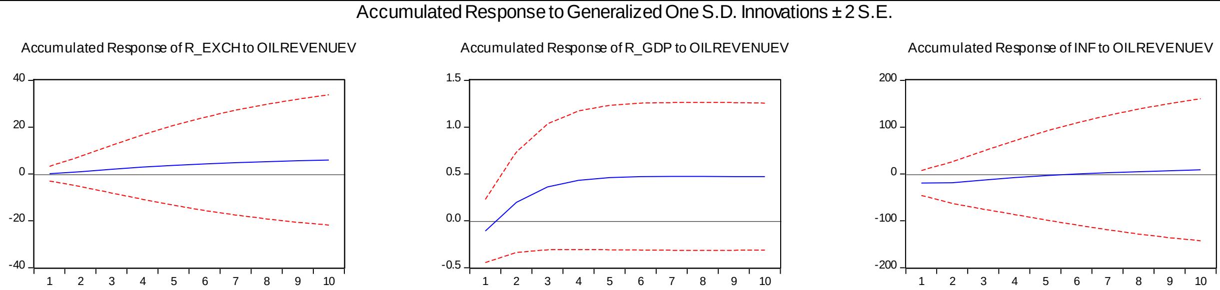
In contrast to the results obtained in OPEC countries, uncertainty in oil revenue has not have a significant impact on economic indicators, and in particular on the government expenditure as a percentage of GDP in non-OPEC countries. A plausible explanation is the existence of sovereign wealth funds in the majority of these countries, in which oil revenues are invested and since any uncertainty and volatility only affects the inflows of cash in those funds, if there is a fluctuation in oil revenues of non-OPEC countries, domestic economy will not be harm.

Figure 5.5. Cumulative generalised impulse responses of oil revenue volatility in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, GOV_EXP= government spending

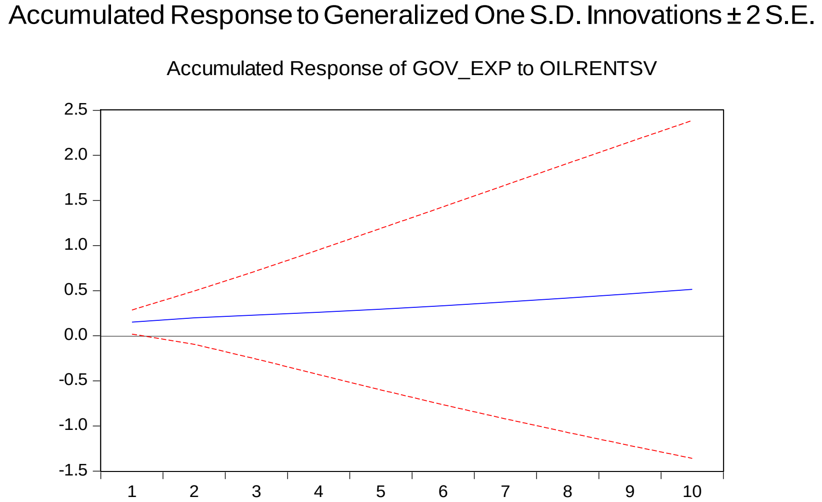
5.2.2.3 Oil rent volatility

Finally, we concentrate on the impact of oil rent volatility on government expenditure in non-OPEC countries (see PGIRFs of Appendix B.6). We observe that OilrentsV exercise a direct marginal effect on GOV_EXP of the non-OPEC countries (see PGIRFs of Fig. 5.6). As noted, with any increase in oil rent volatility in non-OPEC countries, the government ensures that its fiscal policy maintains the expenditure in the economy.

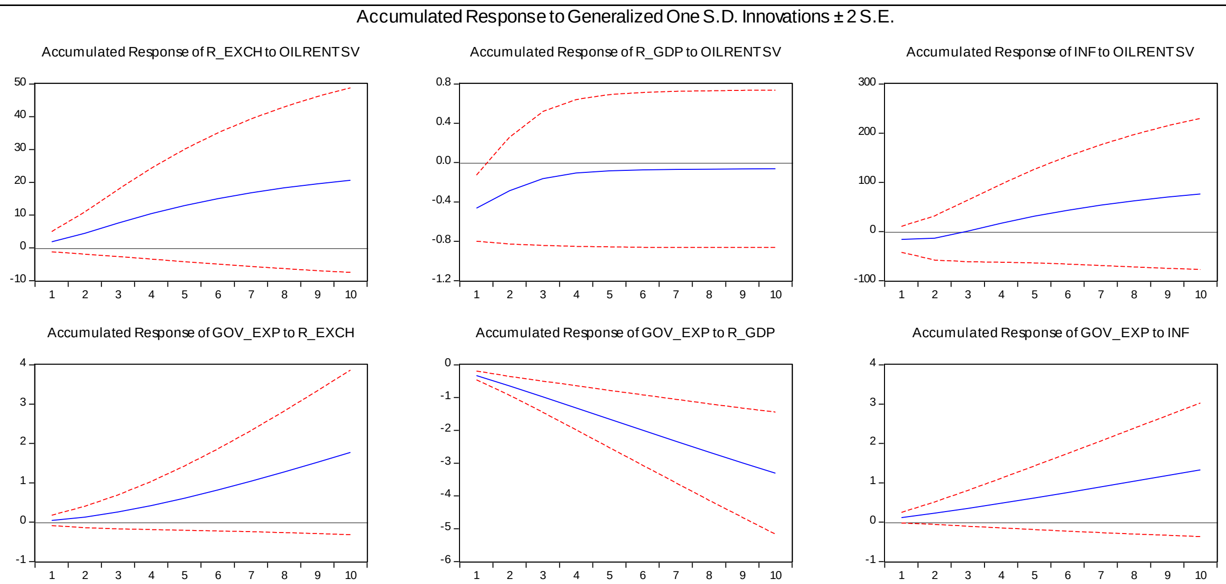
Furthermore, there is an indirect channel by which OilrentsV impacts the GOV_EXP. These effects are propagated via the effects of OilrentsV on R_GDP. The finding indicates that the OilrentsV on R_GDP is also negative in non-OPEC countries and the subsequent reduction in economic growth will lead to an increased share of government expenditure as a percentage of GDP. Oil rents directly affect the value added of oil upstream and downstream industries. Any uncertainty it could lead to a reduction in the value added of the oil industry and, consequently, economic growth. Therefore, a reduction in the added value of the oil industry has harmed the government's tax revenue in these countries and then this will reduce government spending on this channel.

Figure 5.6. Cumulative generalised impulse responses of oil rents volatility in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, GOV_EXP= government spending

5.2.3 Overall comparison between OPEC/non-OPEC countries

In this section, we compare the results of the previous section for the two groups of countries under study. We observed that oil price volatility did not affect economic variables in OPEC countries. Conversely oil price volatility affects economic variables in the non-OPEC countries. It might suggest that OPEC economies are more resilient to oil price volatility by participating in an oil cartel, which provides some measure of protection against the uncertainty of oil prices as Khusanjanova (2011) indicates, at least in sample period of this study. In non-OPEC countries, oil price volatility has a direct impact on government expenditure, as well as an indirect impact through economic growth, and inflation channels. Thus, increasing uncertainty in the oil price from all two of the above channels and the direct impact will increase the share of government expenditure in the economy. The uncertainty impact of the oil price on non-OPEC countries can be because these countries have a more open economy than OPEC countries, as a result, their economic indicators are more susceptible to developments in world markets.

In the results of the oil revenue volatility, the results showed that OPEC countries are susceptible to uncertainty of oil revenues, while this uncertainty has no impact on the economic variables of non-OPEC countries. It has also been mentioned earlier that the lack of susceptibility of non-OPEC countries to the uncertainty of oil revenues can be attributed to the fact that these countries relative to those in OPEC invest a lower percentage of oil revenues directly into their economies. For example, from 1990 Government Pension Fund of Norway invest the surplus revenues of the Norwegian petroleum sector, even in foreign stocks and other countries[1]. In contrast, in Iran, for example, the National Development Fund was established to transform oil and gas revenues into productive investment for future generation. However, in practice, if the oil revenues of oil exports fall below the expected level, Iran's government allowed to withdraw from the fund[2]. As a result, this difference in the policies of the National Wealth Funds can partly explain the different response to the oil revenue volatility in OPEC and non-OPEC countries.

The last indicator of oil volatility was the oil rents volatility. Oil rents volatility impacts both groups of countries; however, the channel of influence is different. In OPEC countries, oil rents volatility exercises both direct and indirect impact on government expenditure via the exchange rate and inflation channel, while in non-OPEC countries, oil rents volatility affects government expenditure directly and it only affects indirectly on government expenditure through GDP channel.

An important point in the impact of volatility indicators on government expenditure in the two groups of countries is the negative impact of oil volatility through the exchange rate channel in OPEC countries, whereas in non-OPEC countries, increased oil volatility will lead to an increased share of government expenditure via all channels except the

[1] https://www.nbim.no/en/

[2] http://en.ndf.ir/default.aspx

exchange rate channel. This difference is likely to be due to the ineffectiveness of the OPEC tax system, which results in a reduction in government revenues and, consequently, a compulsory reduction in government expenditure as a result of increasing the exchange rate and reducing economic growth.

However, any increase in oil volatility will lead to an increase in the share of government expenditure in the economy in both groups of countries. In non-OPEC countries, it seems that the increase in the share of government expenditure results from an interventionist fiscal policy with governments actively engaging with the needs of the economy. However, in the OPEC countries, the increase in government expenditure is more passive and as a result, other economic interactions occur regardless of government fiscal policies.

In Figures 5.7 and 5.8, the mechanisms of impact of oil volatility on the countries under review are shown.

Figure 5.7. Panel A: Oil volatility impacts in OPEC countries

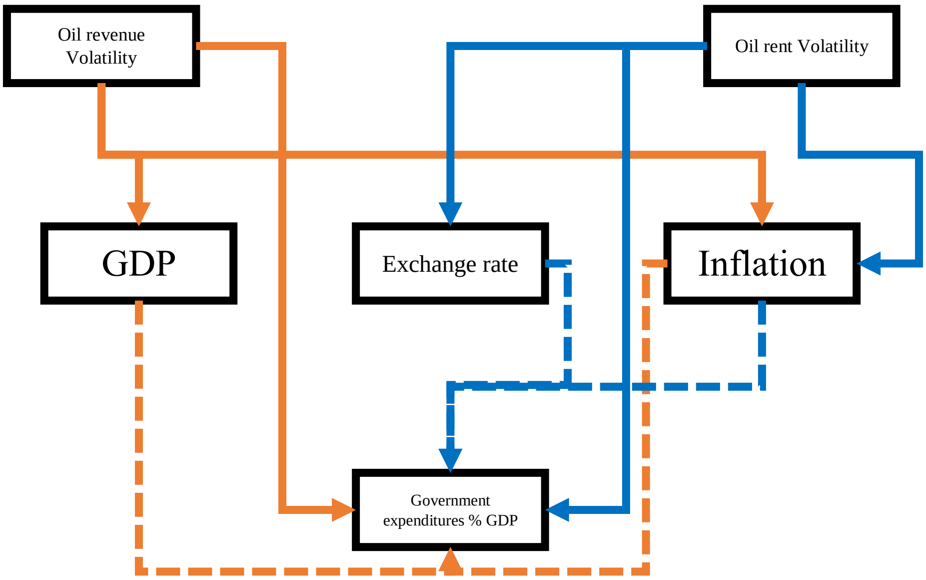
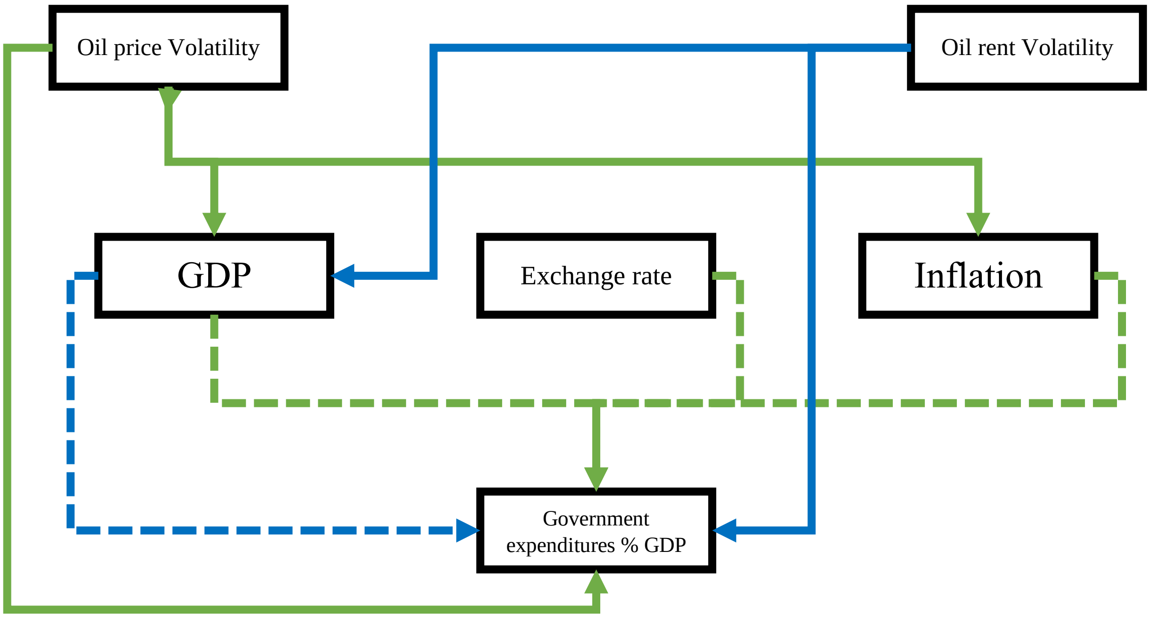


Figure 5.8. Panel B: Oil volatility impacts in non-OPEC countries



Note: Dotted line represent a negative impact of uncertainty and solid line represent a positive impact

5.3 Panel generalised impulse response functions: high and low volatility regimes

In this section we analyse the robustness of our results by means of estimating previous specifications of the PVAR for high and low oil volatility regimes.

5.3.1 OPEC countries analysis

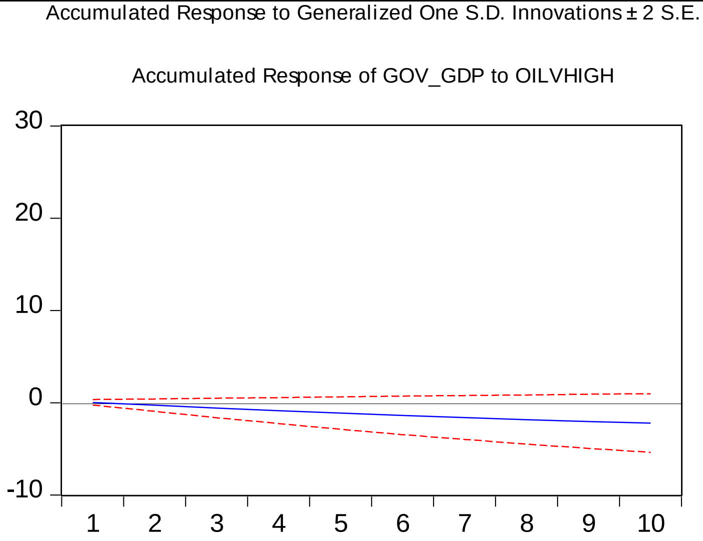
Next, we estimate the PVAR models separately for oil high and low oil volatility regimes for in OPEC countries.

5.3.1.1 Oil price volatility

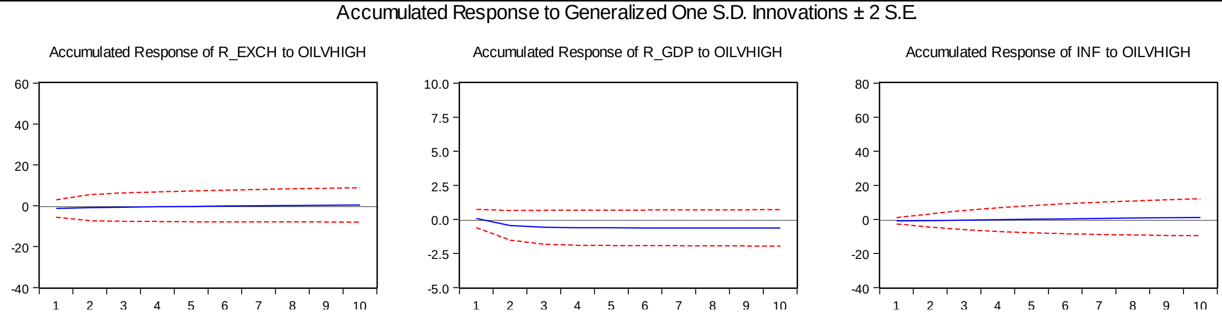
The results for the oil price volatility regimes are shown in Figs. 5.9 and 5.10 (see PGIRFs of Appendixes B.19 and B.20). As shown in the panels' oil price high and low volatility regimes in OPEC countries of Figs 5.7 and 5.8, the impact of increasing oil price volatility on the economic variables of the OPEC countries is not significant either at the high or low volatility regime. As a result, there is no asymmetric impact and its effect is not dependent on the volatility regime.

Figure 5.9. Cumulative generalised impulse responses of oil price high volatility in OPEC countries

Direct effects



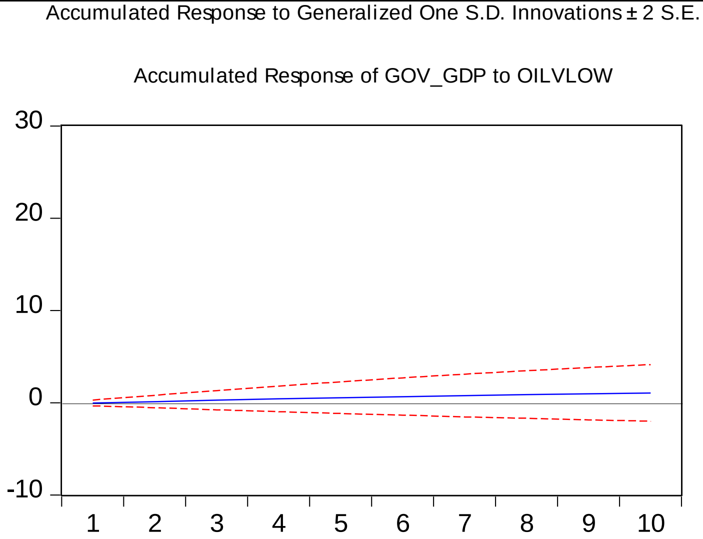
Indirect effects



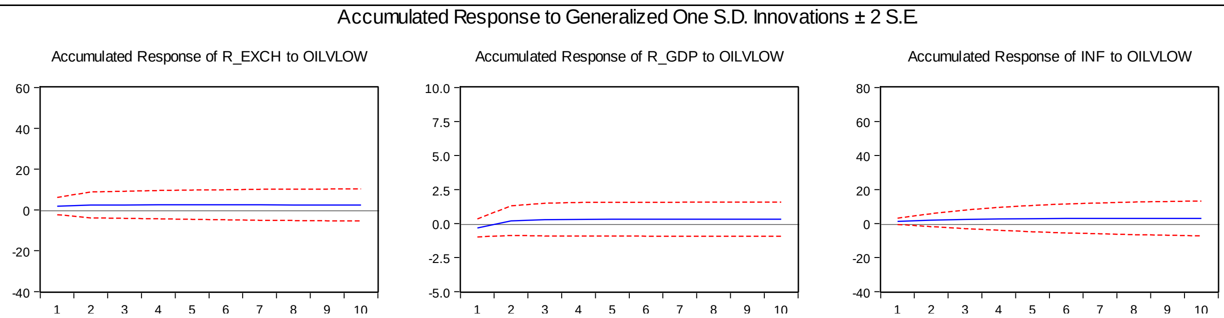
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, GOV_EXP= government spending

Figure 5.10. Cumulative generalised impulse responses of oil price low volatility in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, GOV_EXP= government spending

5.3.1.2 Oil revenue volatility

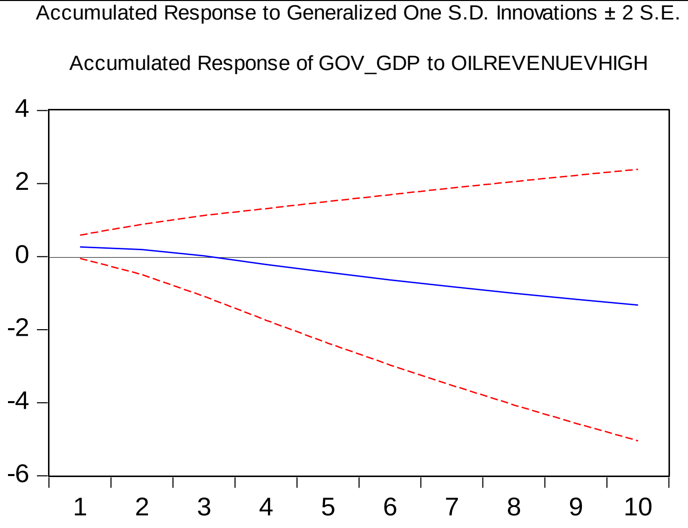
Then, we consider the high and low volatility regime of oil revenue in OPEC countries. The results for this group of countries are presented in Figs. 5.11 and 5.12 (see PGIRFs of Appendixes B.21 and B.22).

It is seen in Figs. 5.9 and 5.10 that the impact of a standard deviation of a positive shock to oil revenue volatility on the studied variables in two high and low volatility regimes is different. As a result, there is an asymmetric impact of oil revenue volatility. In the high volatility regime, the results are similar to those of the previous section. While in a low volatility regime, the positive shock of oil revenue volatility only has a direct impact on the share of government expenditure as a percentage of GDP in OPEC countries, and there is no indirect impact in this section through the economic growth channel. Also, government expenditure responses to the high volatility of oil revenues are less significant relative to a rise in the uncertainty, whereas government expenditure responses to the low volatility of oil revenue are more significant. Since oil volatility does not affect the variables of economic growth, exchange rate and inflation, the government seems to be more active in increasing its expenditure and the share of government expenditure in GDP increases.

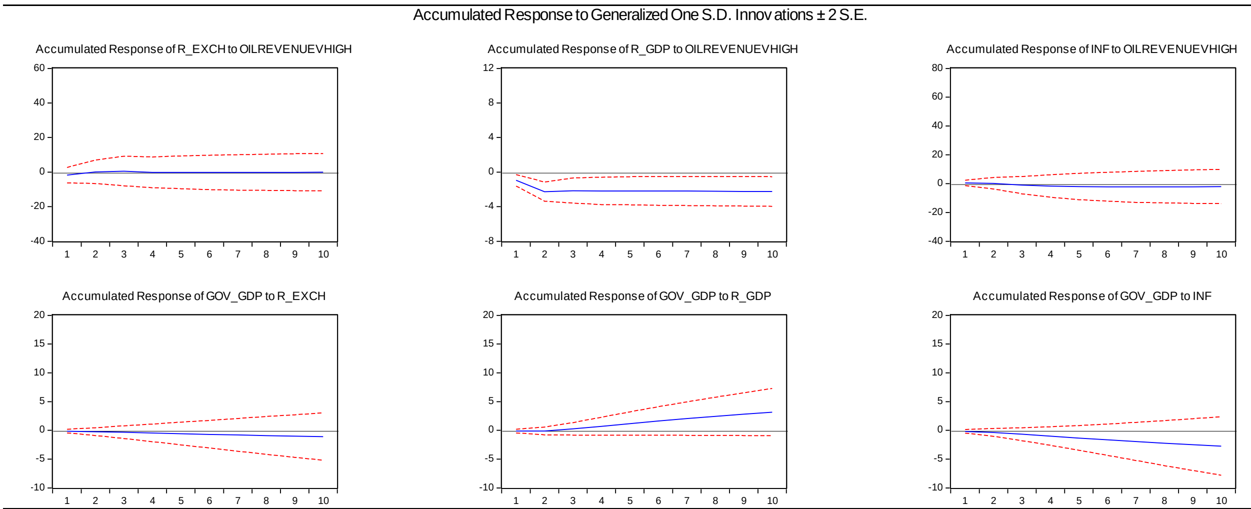
If we look at the difference in response to economic growth in the high and low volatility regimes of oil revenue, we find that in a high volatility regime, with increasing oil revenue volatility, economic growth decreases significantly, which this does not happen in the low volatility regime. Therefore, it appears that when oil revenue volatility is in a low volatility regime, the increase in oil revenue volatility in these countries create a positive economic circumstance which are not degraded as oil revenue volatility rises. This creates an optimistic environment in which government increases expenditure.

Figure 5.11. Cumulative generalised impulse responses of oil revenue high volatility in OPEC countries

Direct effects



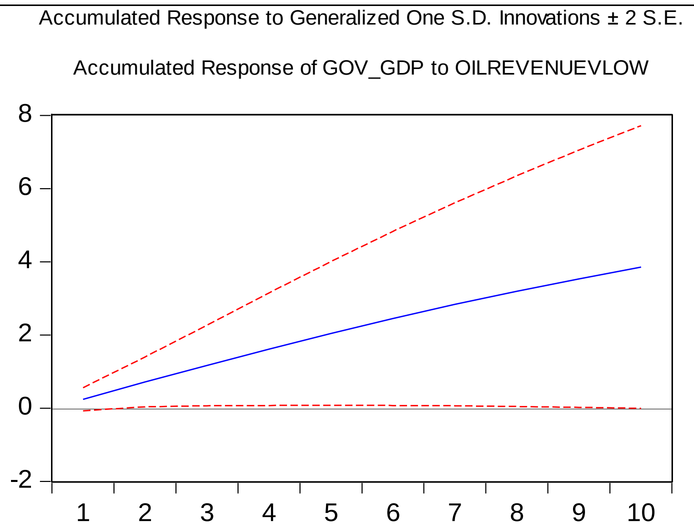
Indirect effects



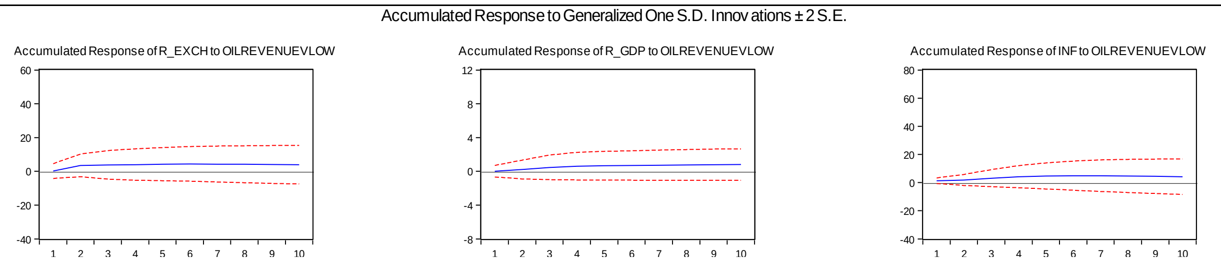
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, GOV_EXP= government spending

Figure 5.12. Cumulative generalised impulse responses of oil revenue low volatility in OPEC countries

Direct effects



Indirect effects



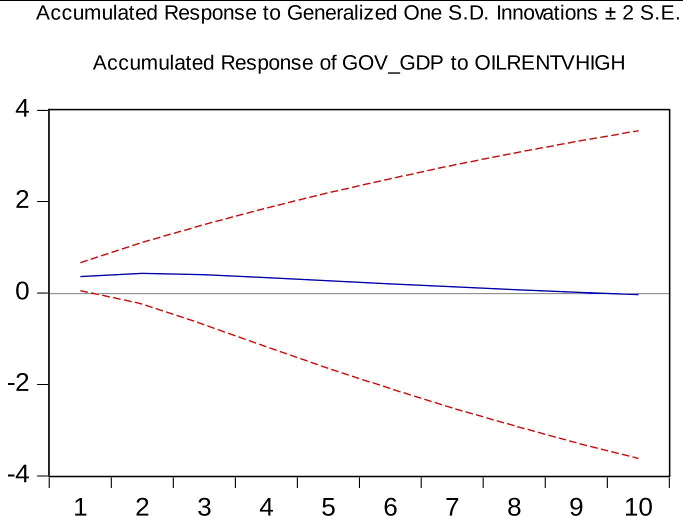
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, GOV_EXP= government spending

5.3.1.3 Oil rent volatility

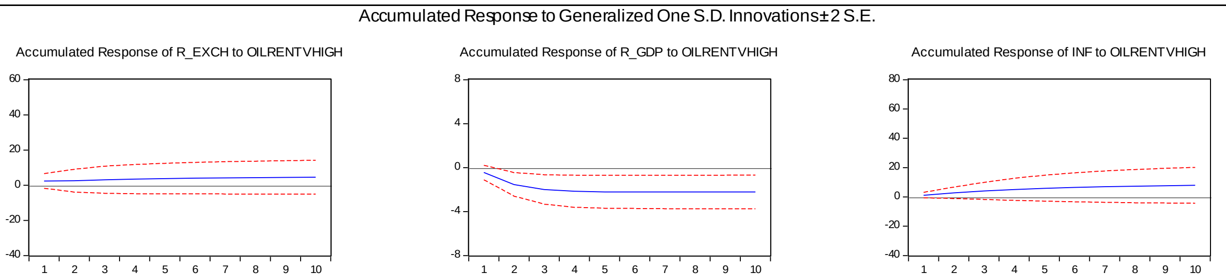
Figures 5.13 and 5.14 present the high and low volatility of oil rents in OPEC countries (see PGIRFs of Appendixes B.23 and B.24). In a high volatility oil rents regime, it is observed that the impact of a standard deviation of oil rent volatility shocks leads to a temporary increase, via the direct channel, in the share of government expenditure as a percentage of GDP. In a regime of low volatility of oil rents, there is no direct or indirect impact of oil rent uncertainty on the share of government expenditure. It seems that when oil rent volatility is high, in OPEC countries in response of oil rent volatility economic growth is reduced due to the negative impact of uncertainty on the nominal and real indicators (rising inflation and decreasing economic growth). Since budgets and current government expenditure are very sticky in this countries (Mattina and Gunnarsson, 2007), the share of expenditure in these economies rising in passive response, and this does not happen in the low volatility regime. Therefore, there is an asymmetric effect that depends on the situation and intensity of oil rent volatility.

Figure 5.13. Cumulative generalised impulse responses of oil rent high volatility in OPEC countries

Direct effects



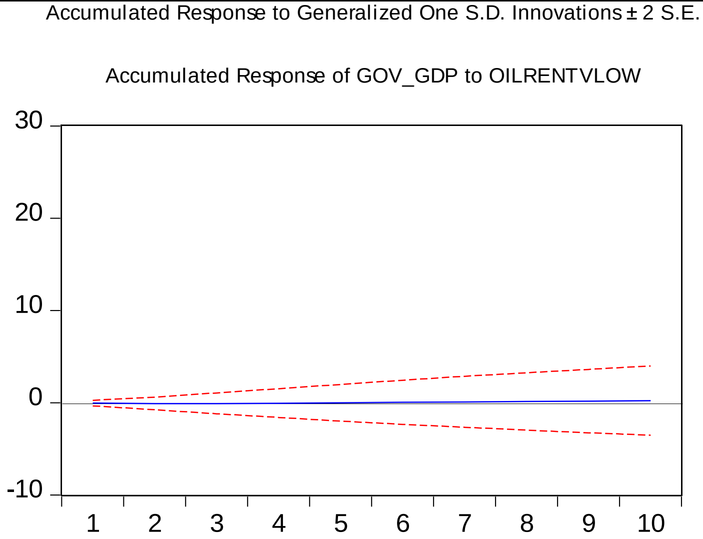
Indirect effects



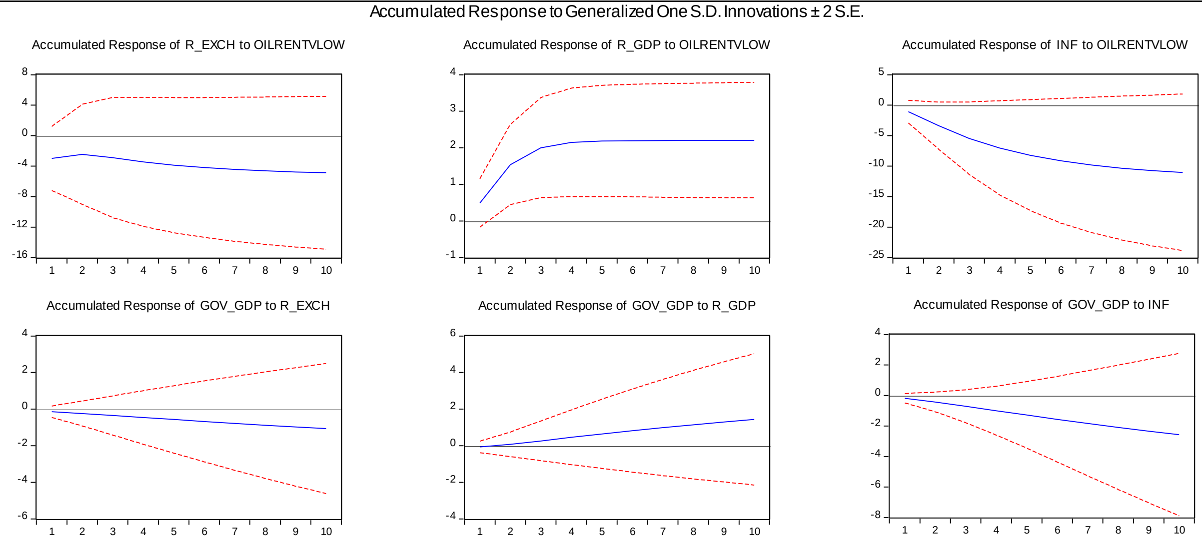
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTVHIGH= oil rent high volatility, GOV_EXP= government spending

Figure 5.14. Cumulative generalised impulse responses of oil rent low volatility in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTVLOW= oil rent low volatility, GOV_EXP= government spending

5.3.2 Non- OPEC countries analysis

We analyse the PVAR models separately for high and low oil volatility regimes in non-OPEC countries.

5.3.2.1 Oil price volatility

In order to analyse oil price high and low volatility regimes on the direct and indirect effect of government spending in non-OPEC countries, we estimate the PVAR model and the results are displayed in Figs 5.15 and 5.16 (see PGIRFs of Appendixes B.25 and B.26).

The findings show that, as in the initial results, in a high volatility regime with an increase in uncertainty over the oil price, the share of government expenditure as a percentage of GDP is rising in non-OPEC countries. Moreover, the positive shock of oil price volatility has a negative impact on the economies of these countries. The exchange rate and inflation are increased, and the economic growth rate reduced, each separate channel increases the share of government expenditure as a percentage of GDP in non-OPEC countries, as described in the previous section.

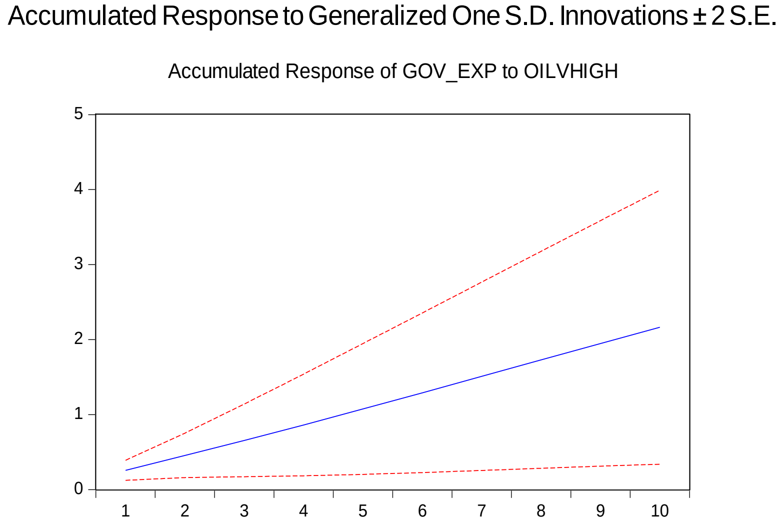
The important point is that when a low volatility regime is established it becomes clear from Figure 5.16 that, with increasing volatility in oil prices, and contrary to the previous section, economic growth increases, and inflation and, exchange rates reduce. In addition, government expenditure as a percentage of GDP has declined from both the direct and indirect channels. In other words, when oil spot price volatility is low, the positive shock of oil price volatility is accompanied by a positive reaction from non-OPEC countries.

In this regard, the uncertainty of the oil price in two regimes with high and low volatility has an asymmetric effect on government expenditure as a percentage of GDP in the non-OPEC countries. In a regime with high volatility, the share of government expenditure increases and in a regime with low volatility it decreases.

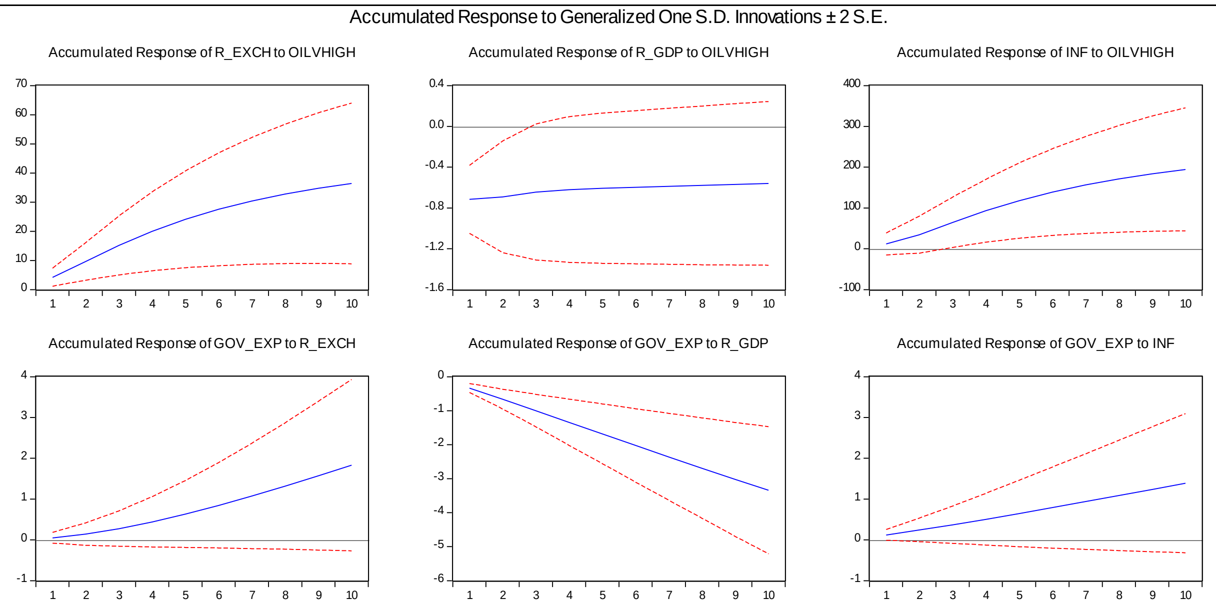
For the economic interpretation of this result, it is better to look at the definition of volatility; “Volatility is allied to risk in that it provides a measure of the possible variation or movement in a particular economic variable” (Aizenman and Pinto 2005) .Therefore, when the volatility is low, there is a low risk for fluctuations in price. Since the results of the impulse response functions in the low volatility regime show a positive impact of increasing oil price volatility in non-OPEC countries, also the volatility in the low-price regime has been more predictable, therefore it has had a positive impact on non-OPEC countries. As a result, the government of these countries do not need to adopt an expansionary fiscal policy to protect the economy from oil price uncertainty albeit that the contrary is true regime with high volatility. Therefore, there is an asymmetric response of government expenditures to oil price volatility.

Figure 5.15. Cumulative generalised impulse responses of oil price high volatility in non-OPEC countries

Direct effects



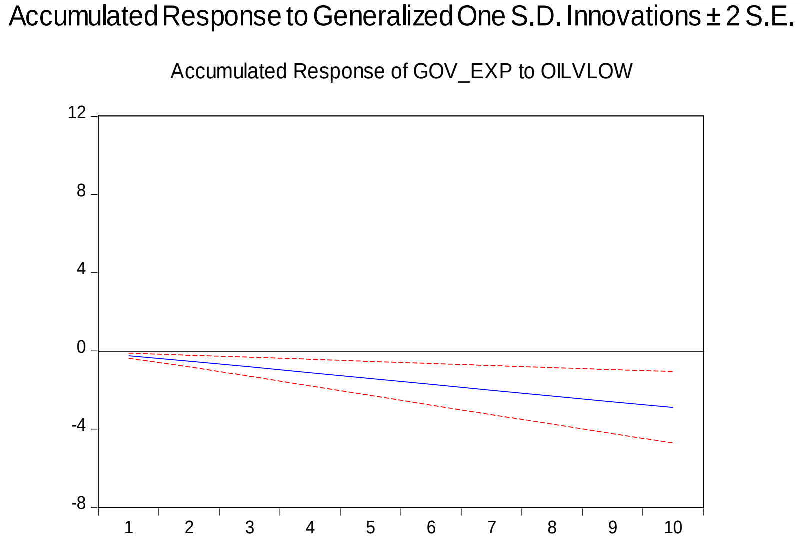
Indirect effects



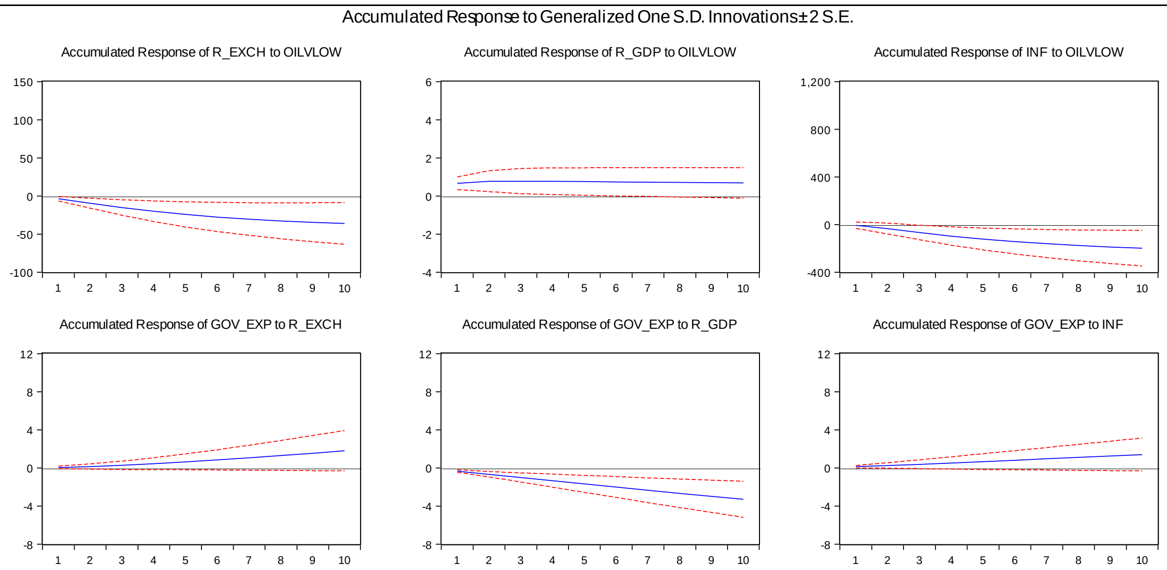
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, GOV_EXP= government spending

Figure 5.16. Cumulative generalised impulse responses of oil price low volatility in non-OPEC countries

Direct effects



Indirect effects



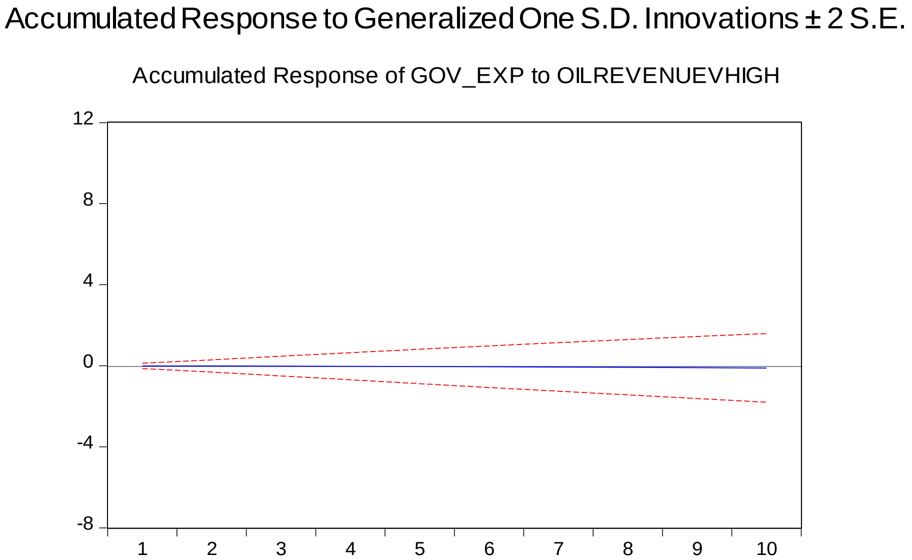
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, GOV_EXP= government spending

5.3.2.2 Oil revenue volatility

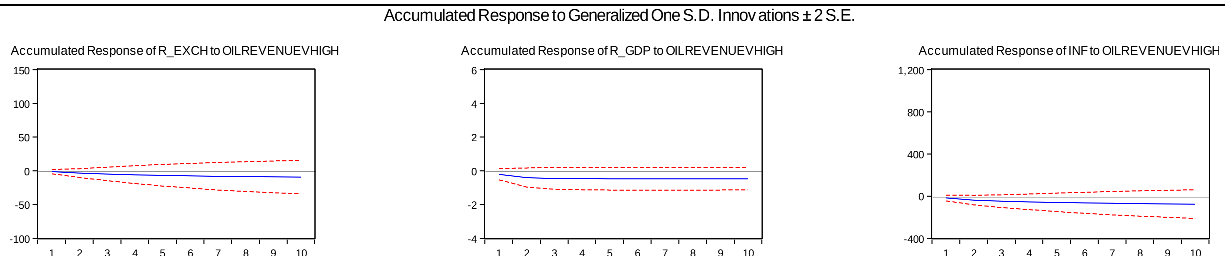
Figures 5.17 and 5.18 present the panel generalised impulse response functions for oil revenue high and low volatility in non-OPEC countries (see PGIRFs of Appendixes B.27 and B.28). In general, we observe that oil revenue volatility has no impact on non-OPEC exporting countries in both regimes which is similar to previous results.

Figure 5.17. Cumulative generalised impulse responses of oil revenue high volatility in non-OPEC countries

Direct effects



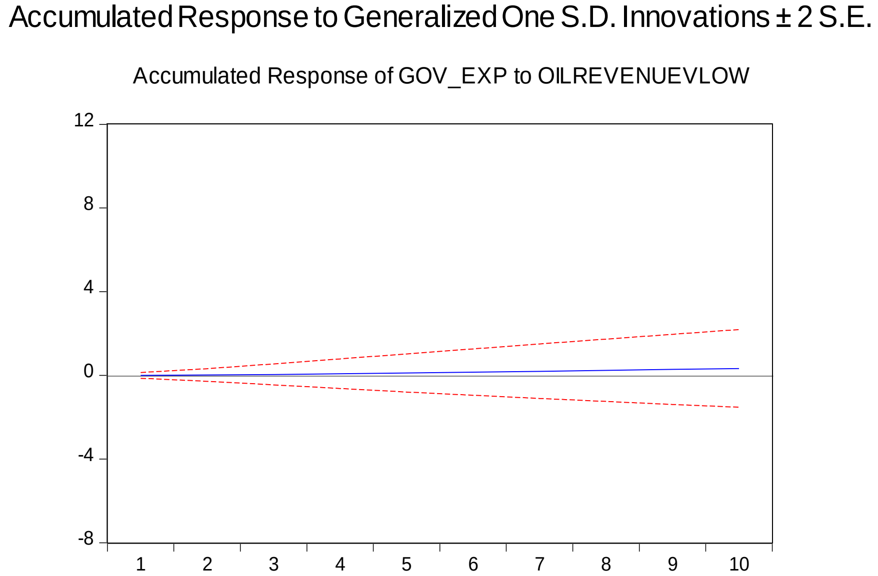
Indirect effects



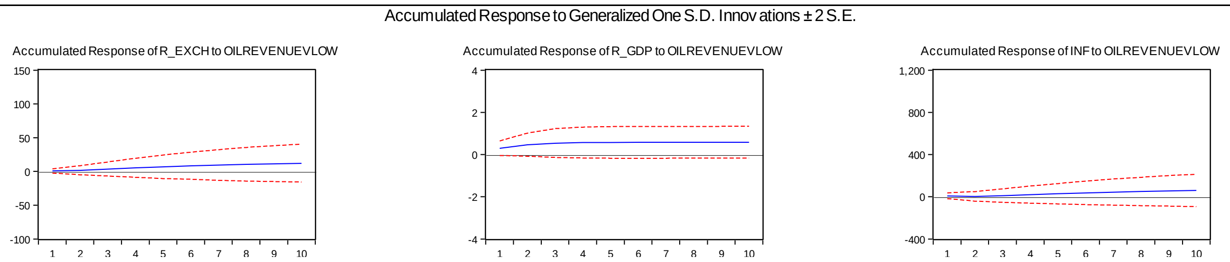
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, GOV_EXP= government spending

Figure 5.18. Cumulative generalised impulse responses of oil revenue low volatility in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, GOV_EXP= government spending

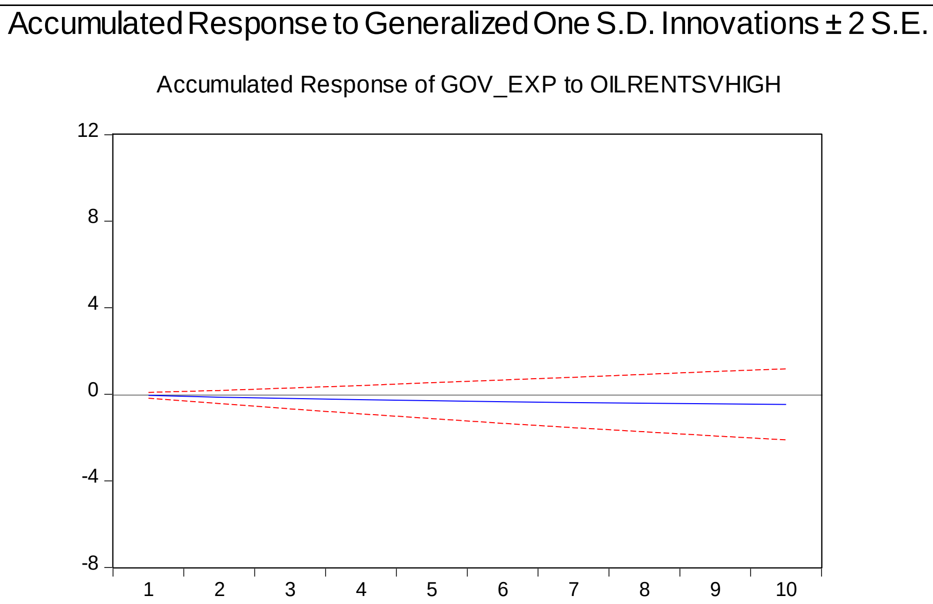
5.3.2.3 Oil rent volatility

Next, we focus on the oil rents high and low volatility on non-OPEC countries. Findings are shown in Figs. 5.19 and 5.20 (see PGIRFs of Appendixes B.29 and B.30). We notice that oil rent high volatility does not exert a direct significant effect on GOV_EXP of the non-OPEC countries. While in the low volatility regime, the results are similar to those of the previous section. As a result, the same mechanism of the impact of oil rents volatility on government expenditure and economic growth is present, but only in a state of low volatility.

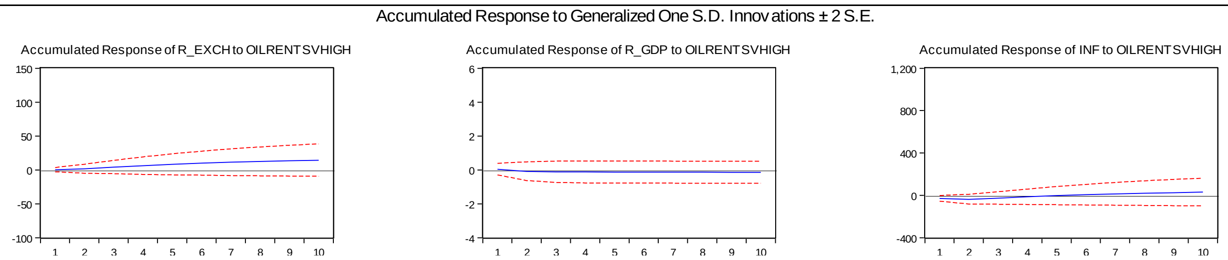
In the low volatility regime, the government does not believe that volatility of oil rents has a negative effect on the economy. It therefore maintenance or slightly increases expenditure to reduce possible negative effects, which results in its rise as a percentage of GDP. Nevertheless, oil rent volatility has a negative impact on the added value of the oil industry and therefore GDP through the indirect channel. The devaluation of the added value of the oil industry has damaged tax revenues in these countries and will therefore reduce government expenditure from this source. The plausible explanation of the asymmetric effect changes in the share of government expenditure in response to the oil rents volatility is that with the increasing economic flexibility of these countries, providing alternative revenue streams when the volatility of oil rents is in the high volatility regime and the risk to oil rents has increased the effect on the economy is natural. As a result, the government is not actively taking steps to change its expenditure. On the Contrary, in the oil rents low volatility regime, forecasting oil rents has increased productive power and resulting in positive expectation of any change in oil rents (As we have seen for the oil price volatility). Therefore, the government exerts a slight increase in expenditure in these countries. However, an increase in the volatility of oil rents has little negative effect even in low volatility regime for the oil industry in these countries. Thus, the share of government spending as a percentage of GDP will eventually rise.

Figure 5.19. Cumulative generalised impulse responses of oil rent high volatility in non-OPEC countries

Direct effects



Indirect effects

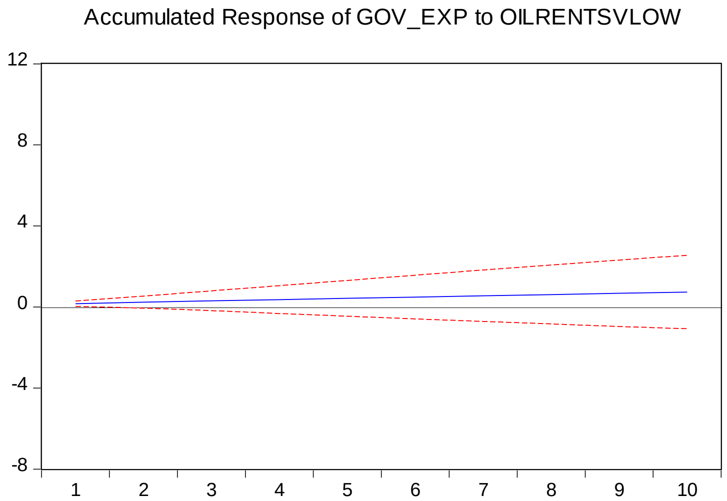


Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTVHIGH= oil rent high volatility, GOV_EXP= government spending

Figure 5.20. Cumulative generalised impulse responses of oil rent low volatility in non-OPEC countries

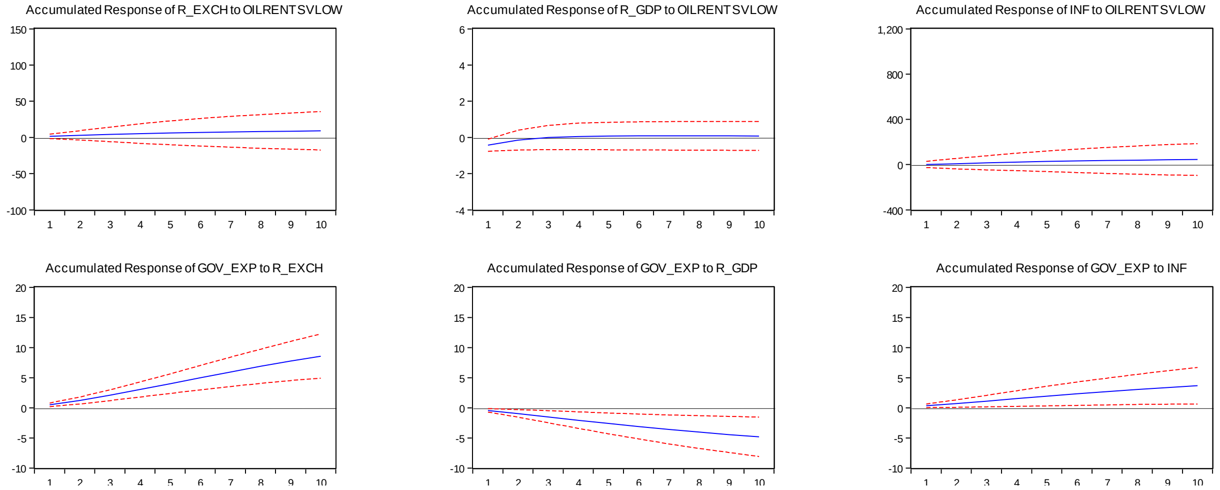
Direct effects

Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.



Indirect effects

Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTVLOW= oil rent low volatility, GOV_EXP= government spending

5.3.3 Overall comparison between OPEC/non-OPEC countries

In this section, we divided the oil volatility regimes and analysed the samples into two sections of high and low volatility to examine the potentially symmetrical effects of oil volatility indications on the countries under investigation (See Table 5.1). There is no evidence of asymmetric effects of OilV on GOV_EXP in OPEC countries. As a result, the volatility of oil prices in these countries is not dependent on the volatility regime. In non-OPEC countries, however, significant results were obtained from the asymmetric impacts of the oil price. Whilst rising uncertainty in the high volatility regime has had a negative impact on the economy of these countries together with an increase in the share of government expenditure, in a low volatility regime, positive shock to volatility has been accompanied by rising economic growth, falling inflation and exchange rates, and consequently, the share of government expenditures decreases. As a result, the reaction of these countries is quite asymmetric and depends on the volatility regime of oil prices. These countries, relative to OPEC countries are more affected by the uncertainty of the world oil market.

Moreover, the findings show that there is no impact of oil revenue volatility regimes on macroeconomic variables in non-OPEC countries, but the OPEC countries experience asymmetric impacts. In a high volatility regime, the uncertainty of oil revenues increases the share of government expenditure and decreases economic growth, but in a low volatility regime, only the share of government expenditure increases, thus we experience an asymmetric impact dependent on the volatility regime.

Finally, when dividing oil rent volatility into a high volatility regime and low volatility regime, we note that, in a high volatility regime, the uncertainty of oil rent increases the share of government expenditure through both direct and indirect channels in OPEC countries. But in a low volatility regime, the uncertainty of oil rent has no significant impact. As a result, the impact is asymmetric. Additionally, in non-OPEC countries there is no significant impact of the high volatility regime on government expenditure, whereas there some uncertainty relating to government expenditure and economic growth within a low oil rents volatility regime.

Table 5.1. Oil volatility impact on the government expenditure % GDP in low and high volatility regimes

Volatility proxy	Group	Low volatility regime	High volatility regime
Oil price volatility	OPEC	-	-
	Non-OPEC	Negative (direct and indirect impact)	Positive (direct and indirect impact)
Oil revenue volatility	OPEC	Positive (direct impact)	Positive (direct and indirect impact)
	Non-OPEC	-	-
Oil rent volatility	OPEC	-	Positive (direct and indirect impact)
	Non-OPEC	Positive (direct and indirect impact)	-

5.4 Conclusion

In this chapter, we investigated the direct and indirect impact of oil volatility on aggregated government spending in OPEC and non-OPEC countries. The sample period runs from 1983 to 2015 and a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions are used in this research. The use of this methodology allows us to control for cross-country unobservable heterogeneity, account for time fixed-effects, analyse the dynamic relationship between the different variables, and most importantly, to address the endogeneity problem often found in these types of studies.

The results of our empirical analysis provide a number of conclusions. Oil price volatility does not exert any significant direct or indirect effect on aggregated government spending of OPEC countries, whereas non-OPEC countries are very susceptible to oil price uncertainty. With increasing oil price uncertainty, economic growth has fallen, and inflation and exchange rates are increasing in the non-OPEC countries. In other words, the oil price volatility has a significant negative impact on these countries.

However, the impact of oil revenue volatility between the two groups of countries is different. The higher oil revenue volatility does not have a significant impact in non-OPEC countries, whereas in OPEC countries, there is a decline in economic growth and inflation, and in particular, increased government expenditure as a percentage of GDP. This is also seen for oil rents volatility. It is also the case that oil rents volatility has a negative impact on economic growth in non-OPEC countries, which translates into oil rents having an impact on the added value of the oil industry in these countries.

In the second part of this chapter we examined the PVAR models separately for high and low oil volatility regimes to identify potentially asymmetric effects. The most important result from this section is that when oil price volatility is high, so non-OPEC countries have seen the negative impact of rising volatility in oil prices, while in a low volatility regime we get a contrary result with an increase in oil price volatility having a positive impact. Moreover, the response to government expenditure as a percentage of GDP in these two regimes is such that with increasing high volatility of oil price and the negative impacts on the economy, the government expenditure as a percentage of GDP increases. Whereas, in non-OPEC countries, with increasing low volatility of the oil price and the positive effects on the economy, government expenditure as a percentage of GDP decreases.

In general, the results suggest that the increase of government expenditure in GDP as a percentage of GDP in OPEC countries after increasing oil volatilities is linked to the flow of oil revenues entering these countries. In other words, OPEC countries do not react significantly to price volatility until their revenue becomes unreliable and they have the ability to moderate the volume of oil exports so that oil revenues are not turbulent. However, when their oil revenue and oil rents fluctuate and their economies are exposed to risk and uncertainty, we will see negative effects, including rising inflation, lowering economic growth and increasing exchange rates. In this situation, the percentage of government expenditure in GDP will eventually increase due to a decline in volume, the growth of the general level of prices and the depreciation of the national currency. In contrast, the findings in non-OPEC countries show that oil price volatility is more important to them than revenue volatility and oil rents volatility.

In addition, the dependence on oil revenue for oil-exporting OPEC countries has caused oil price change to be the main source of macroeconomic fluctuations. This in turn, has important effects on both economic activities and macroeconomic policy (Chemingui and Hajeeh 2011; Emami and Adibpour 2012). Therefore, it is important to identify the reason for the positive or negative effect of volatility on the government expenditure ratio to establish whether countercyclical fiscal policies are required. For example, building the appropriate political and economic policies to ensure that the appropriate fiscal response is selected dependant on the environment created and building incentives that ensure they are respected. It would be appropriate to retire debt during windfall episodes or increase expenditure with additional debt in periods of recession to stimulate growth.

Another important point is the difference in government response to uncertainty among the two countries group. According to the estimated results, a government induced response to any increase in government expenditure in OPEC countries is less likely to be a discretionary policy, but according to the evidence of this research model, it does happen more as a passive action due to changes of situation (like decreased government income due to oil volatility impacts). In contrast, in non-OPEC it appears that in response to a negative impact of oil price uncertainty, the share of government expenditure increases occurred as an active response and discretionary policy-making.

Further research in the field should incorporate the origin of oil price shocks and oil volatilities; that is, whether the shock comes from the supply-side or the demand-side. This analysis could be extended to analysing volatility of oil demand and oil supply shocks and to a micro-analysis at industry level. Also, further study could examine the negative oil volatility on government spending in OPEC and non-OPEC countries.

Chapter 6- Empirical Studies on Oil Volatility and Disaggregated Government Expenditure

6.1 Introduction

In this chapter, the direct and indirect effect of oil volatility on disaggregated government expenditure is examined. This study analyses the dynamic effects of oil price volatility, oil rent volatility and oil revenue volatility on different categories of the OPEC and non-OPEC governments' expenditure from 1983 to 2015, using a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions. To capture the full dynamics of the aforementioned relationship in a PVAR setting, it also considers core macro-economic variables, namely GPD per capita growth rate, inflation and exchange rates.

As shown in the review of the related literature (see Chapter 2), it is relatively silent on the effects of oil price volatility, oil rent volatility and oil revenue volatility on disaggregated government expenditure for oil exporting countries. To date, there is only one study that examines the effect of oil revenue shocks on the different categories of Iranian government expenditure (Farzanegan 2011). It is believed that this is the first research study that adopts a panel VAR approach, and a panel impulse response analysis, to study the dynamic impact of oil price volatility, rent volatility and revenue volatility on disaggregated government expenditure by taking into account the endogeneity of these variables.

As already shown in Chapter 4, the PVAR model is estimated using the following variables, namely, oil price volatility proxies (OilV, OilrentsV, OilrevenueV), inflation (INF), exchange rates (R_EXCH), economic growth per capita (R_GDP), disaggregate government expenditure that consists of education expenditure (Education_EXP), military expenditure (Military_EXP), and health expenditure (Health_EXP). In Chapter 4, this study will establish that the variables are stationary, and, thus, the study can now proceed with the analysis of the PVAR model and its impulse responses, concentrating on the direct and indirect effects of the oil volatility proxies and the main different categories of government expenditure.

6.2 Panel generalised impulse response functions: full sample analysis

This section will present the empirical evidence of the panel generalised impulse response functions, as discussed, based on the estimation of Eq. (3.1), with a lag order of 4, determined by the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). Therefore, it will calculate the generalised panel impulse response functions tracing out the reaction of disaggregated government expenditure (of OPEC and non-OPEC countries) on oil volatility shocks, which could be direct or indirect via the other macroeconomic variables.

6.2.1 OPEC countries analysis

The discussion begins with the impulse responses results based on the full sample of OPEC countries. The results are shown from Fig 6.1 to Fig. 6.9 for the oil price volatility (OilV), oil revenue volatility (OilrevenueV) and oil rents volatility (OilrentsV), respectively.

6.2.1.1 Oil price volatility

The direct and indirect results of oil price volatility, and the effect on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP), are reported in Figs. 6.1, 6.2 and 6.3.

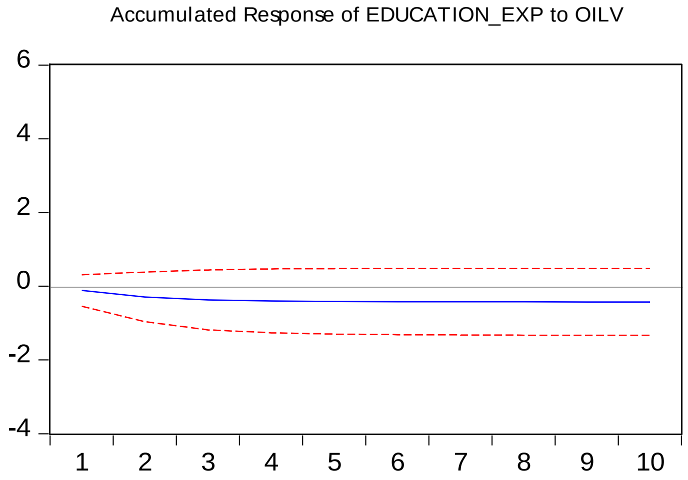
6.2.1.1.1 <u>Education expenditure</u>

As mentioned in chapter 5, the increased oil price volatility does not have a significant effect on OPEC countries and the possible reasons were discussed (see PGIRFs of Appendix C.1). The results obtained in this section are also in line with the previous ones. Although, education expenditure has been separated from the government expenditure budget, in this part, there is still no significant effect in relation to oil price volatility. It means that increased oil price uncertainty in OPEC countries does not lead to a significant change in the ratio of government education expenditure as a percentage of GDP. As the economic growth response to oil price volatility is not significant, the absolute education expenditure value does not change when responding to increased oil volatility. The possible reasons for a lack of the impact of oil price volatility in the OPEC countries were discussed in the previous chapter.

Figure 6.1. Cumulative generalised impulse responses of oil price volatility on education expenditure in OPEC countries

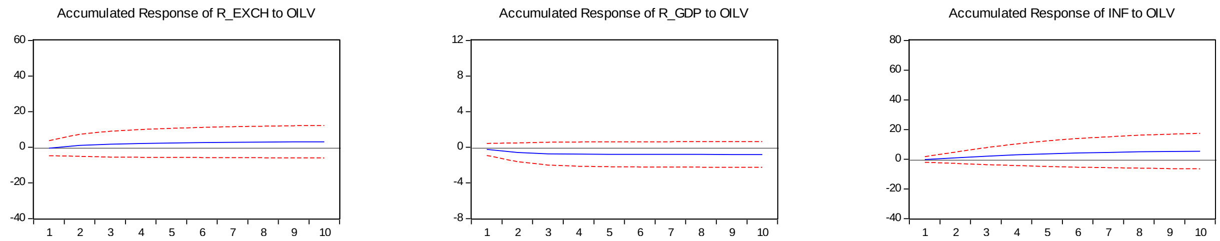
Direct effects

Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.



Indirect effects

Accumulated Response to Generalized One S.D. Innovations±2 S.E.



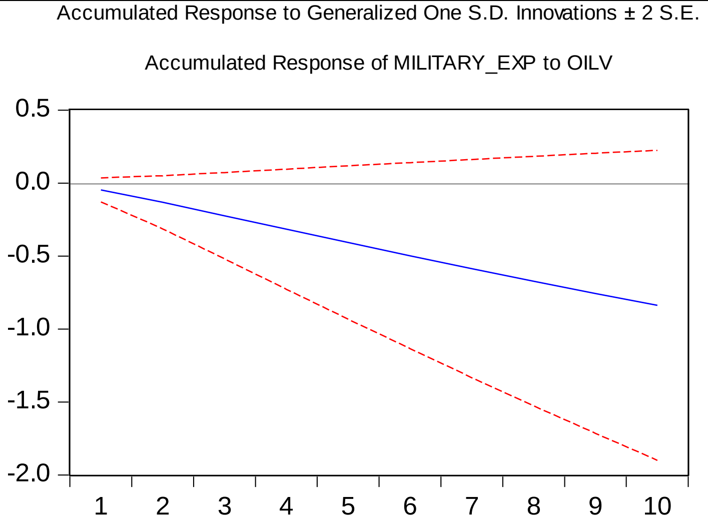
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, EDUCATION_EXP= education expenditure

6.2.1.1.2 <u>Military expenditure</u>

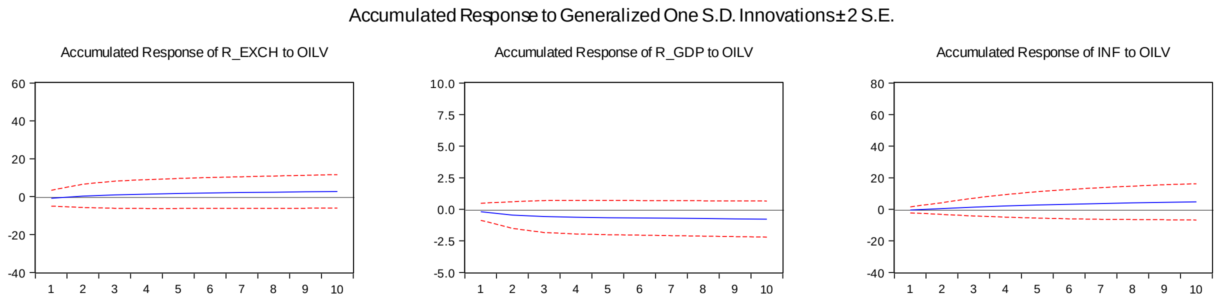
Reference to Figure 6.2 shows that an increase in oil price volatility in OPEC countries leads to a reduction in military expenditure (see PGIRFs of Appendix C.2). However, this is not due to the effects of changing income, inflation or exchange rate channels. It has been estimated that oil price volatility has a direct and negative effect on military expenditure in relation to GDP. According to the results obtained in chapter 5, oil price volatility does not exert any significant effect on government expenditure, and, therefore, the reduction in military expenditure contribution should be in line with an increase in another part of the government budget, in order to have a fixed total government expenditure. Furthermore, the absolute value of military expenditure has declined due to the lack of the effect of oil price uncertainty on economic growth. As the economic indicators have not responded to oil price volatility in these countries, the reduction in their military expenditure may be attributed to some mechanisms, which are exogenous. For instance, military weapon suppliers may decide not to sell military weapons when there is an increase in oil price uncertainty; therefore, the military expenditure of OPEC countries will be automatically reduced. This case may be crucial as many OPEC countries import military weapons.

Figure 6.2. Cumulative generalised impulse responses of oil price volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



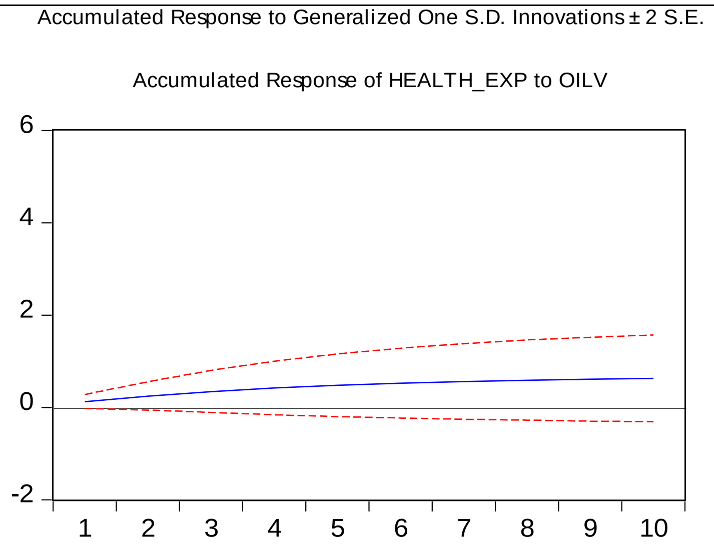
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, MILITARY_EXP= military expenditure

6.2.1.1.3 ***Health expenditure***

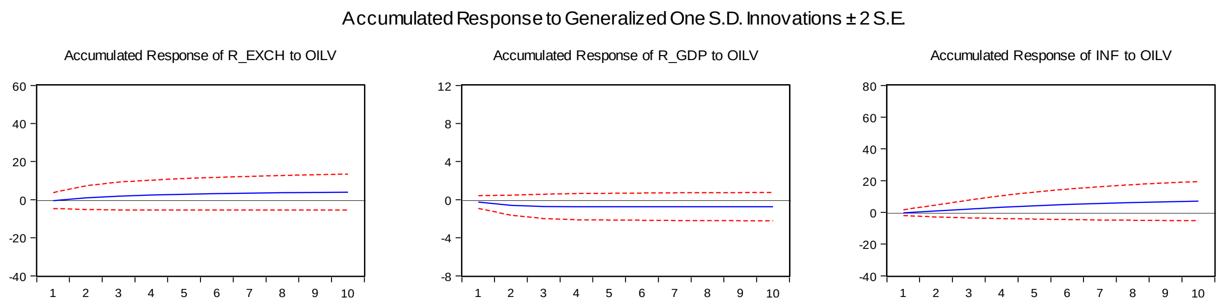
As expected, the reduction in military expenditure should occur with an increase in the contribution of other government budget components, in order to experience no change in the share of total government expenditure as a result of increased oil price volatility in accordance with the results of the previous chapter (see PGIRFs of Appendix C.3). The results in this section shows that oil price volatility, in OPEC countries, exercises a direct positive effect on health expenditure, suggesting that when oil price uncertainty increases this leads to a higher health expenditure (as a percentage of GDP) contribution in their budget. However, oil price volatility does not have any indirect effect (through income, inflation and exchange rates channels) on health expenditure. As economic growth does not respond to oil price uncertainty, an increase in health expenditure is due to the absolute value of health expenditure in of OPEC countries. Hence, increased health expenditure cannot be attributed to the domestic economy of these countries because their economic indicators do not respond to oil price uncertainty. One of reasons for this may be the rising price of medical equipment, medicine etc. at the global level due to increasing oil price volatility. In addition, OPEC countries would experience rising health costs since they have to import a part of their health and medicine requirements.

Figure 6.3. Cumulative generalised impulse responses of oil price volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, HEALTH_EXP= health expenditure

6.2.1.2 Oil revenue volatility

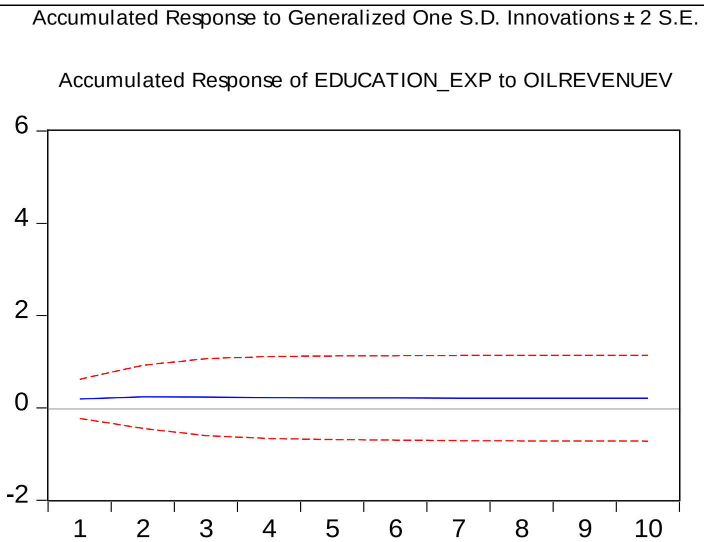
This study will consider the direct and indirect effect of oil revenue volatility on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP). Results are displayed in Figs. 6.4, 6.5 and 6.6.

6.2.1.2.1 Education expenditure

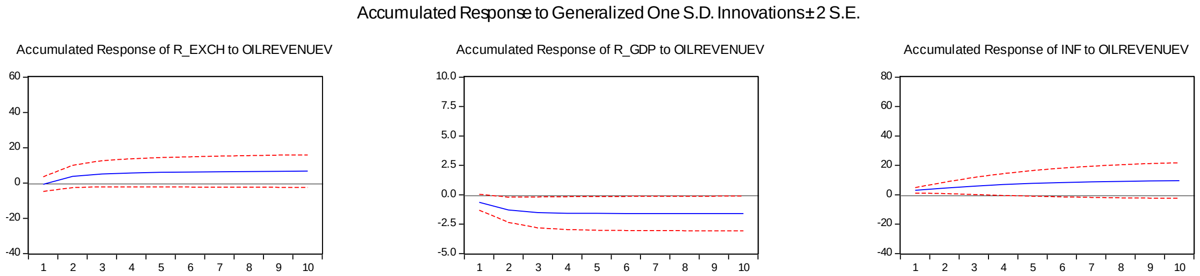
Education expenditure does not change in response to the shock of oil revenue volatility, such as oil price volatility in OPEC countries (see PGIRFs of Appendix C.4). In other words, education expenditure as a percentage of GDP will remain constant in the case of rising oil revenue uncertainty in these countries. The stable share of education expenditure may occur due to the reduction in absolute value of education expenditure equal to the reduction in income caused by uncertainty. In fact, the government in OPEC countries decided to decline a reduction in education expenditure when facing uncertainty in oil revenues, which finances a large part of the budget in these countries. Therefore, education expenditure will remain constant due to decreased GDP.

Figure 6.4. Cumulative generalised impulse responses of oil revenue volatility on education expenditure in OPEC countries

Direct effects



Indirect effects



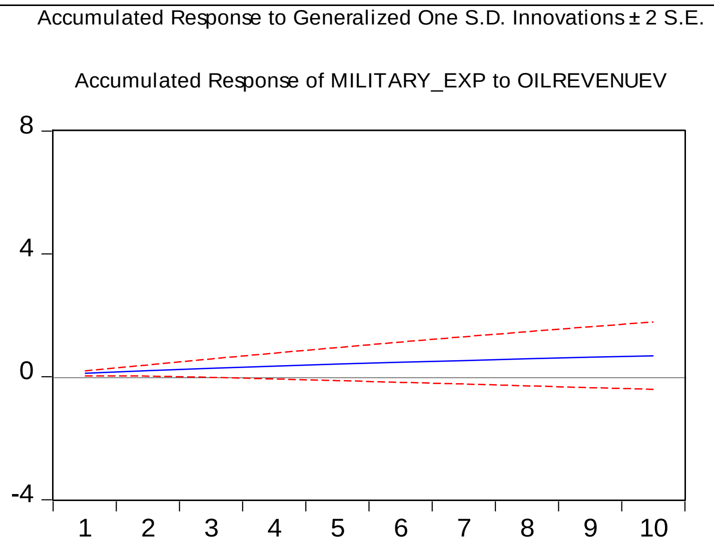
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, EDUCATION_EXP = education expenditure

*6.2.1.2.2 **Military expenditure***

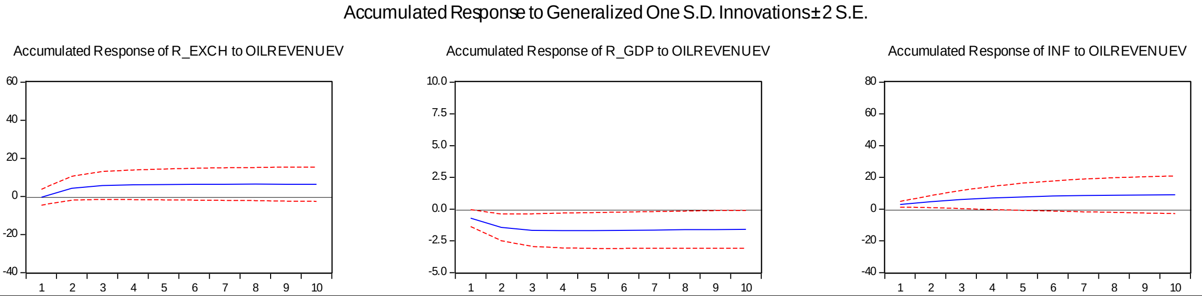
According to Figure 6.5, the higher oil revenue volatility leads to higher military expenditure as a percentage of GDP in the OPEC countries (see PGIRFs of Appendix C.5). However, there is no significant indirect effect on military expenditure. As a result, higher military expenditure as a percentage of GDP may be related to income reduction or relatively constant military expenditure in the budget.

Figure 6.5. Cumulative generalised impulse responses of oil revenue volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, MILITARY_EXP= military expenditure

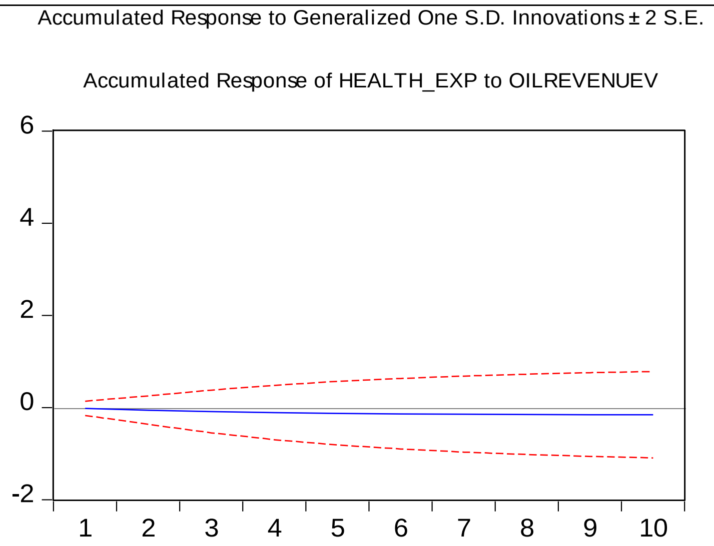
6.2.1.2.3 ***Health expenditure***

It is seen in Fig. 6.6 that oil revenue volatility does not exert any significant direct or indirect effect on health expenditure (see PGIRFs of Appendix C.6).

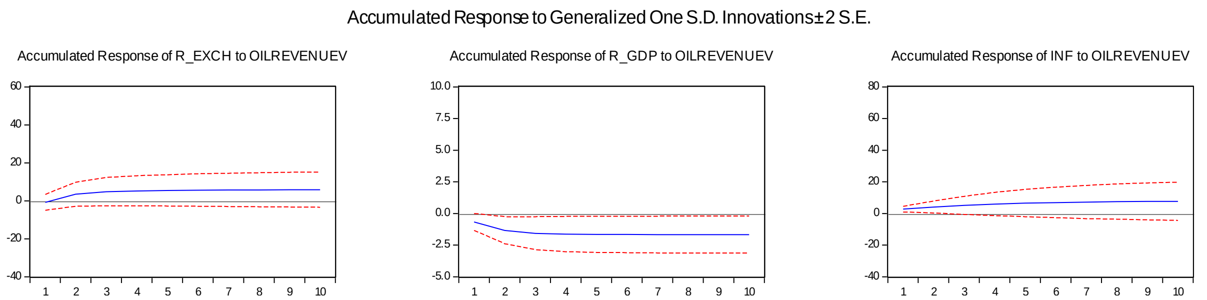
As higher oil revenue volatility does not have any indirect effect on health expenditure, increasing uncertainty in oil revenue does not affect the health expenditure through income, inflation and exchange rate channels. The only possible reason for no change in the share of health expenditure can be attributed to the reducing absolute value of health expenditure in the budget, or the same reduction in the GDP of OPEC countries, so that the share of health expenditure remains fixed in relation to GDP.

Figure 6.6. Cumulative generalised impulse responses of oil revenue volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, HEALTH_EXP= health expenditure

6.2.1.3 Oil rent volatility

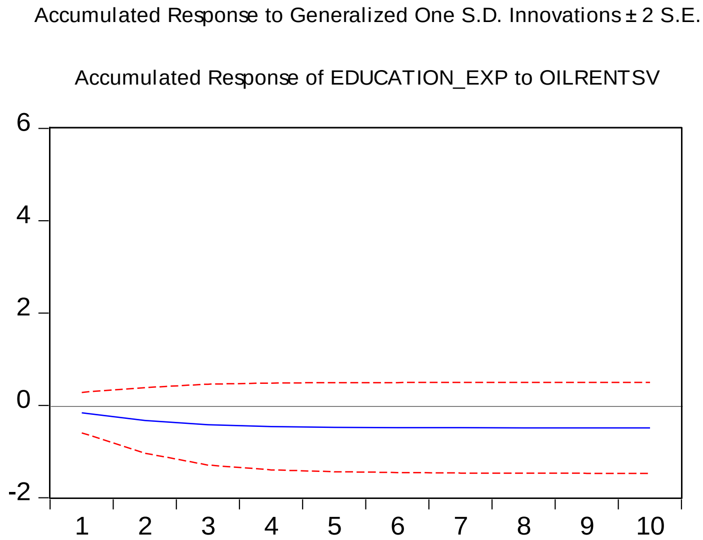
Next, this study proceeds with the PVAR results based on the direct and indirect effect of oil rent volatility on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP), which are presented in Figs. 6.7, 6.8 and 6.9.

6.2.1.3.1 <u>Education expenditure</u>

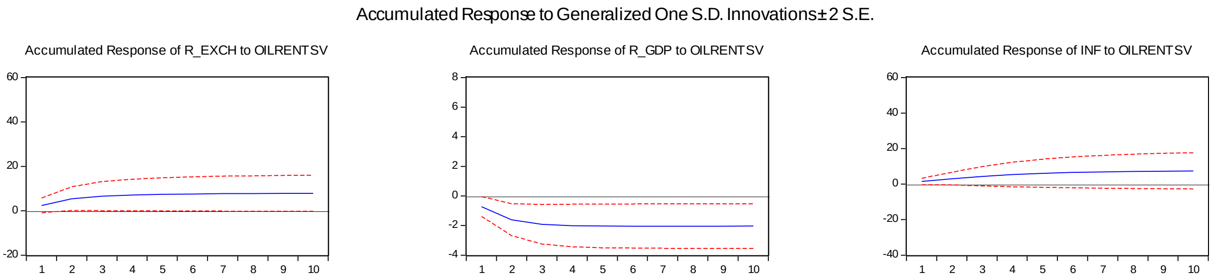
As was mentioned in the previous chapter, increasing volatility in oil rent leads to an increase in the share of government expenditure in GDP in OPEC countries (see PGIRFs of Appendix C.7). However, the results of this section show that the share of education expenditure as a percentage of GDP is fixed. In addition, oil rent volatility does not have an indirect effect on this variable. Since the R_GDP has been reduced due to higher oil rents volatility, the constant education expenditure as a percentage of GDP is associated with the same reduction in the education expenditure absolute value.

Figure 6.7. Cumulative generalised impulse responses of oil rents volatility on education expenditure in OPEC countries

Direct effects



Indirect effects



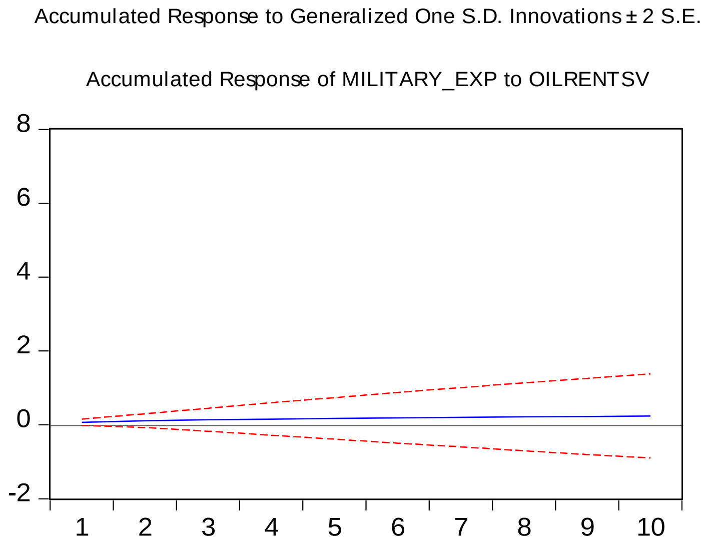
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, EDUCATION_EXP= education expenditure

*6.2.1.3.2 **Military expenditure***

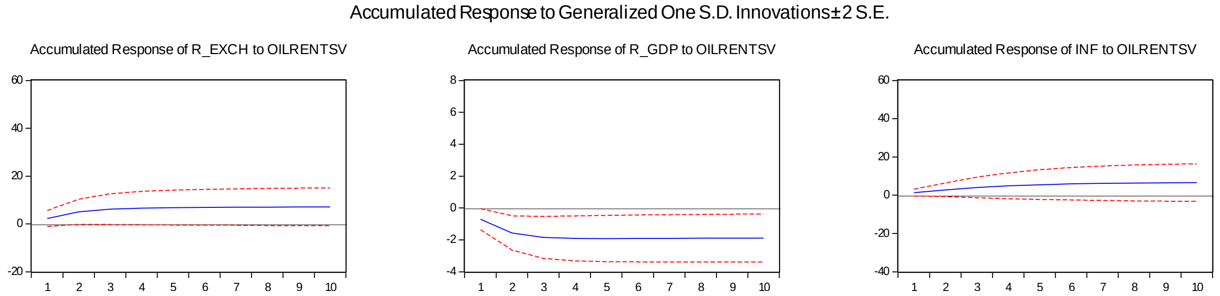
Unlike before, it is observed that the response of military expenditure as a percentage of GDP to a positive shock of oil rent volatility remains constant in OPEC countries (see PGIRFs of Appendix C.8). Like the previous case, in which the GDP has been reduced, the lack of change in military expenditure in GDP has occurred due to the same reduction in military expenditure.

Figure 6.8. Cumulative generalised impulse responses of oil rents volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, MILITARY_EXP= military expenditure

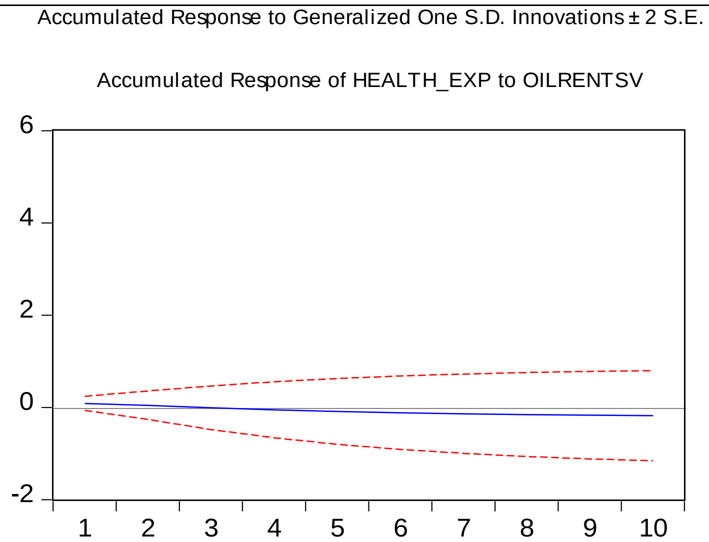
6.2.1.3.3 Health expenditure

Finally, it can be observed that oil rent volatility does not have a significant effect on the health expenditure in OPEC countries, so that the reason for the fixed health expenditure can be attributed to the GDP reduction and the same decline in health expenditure's absolute value (see PGIRFs of Appendix C.9). As was mentioned in the previous chapter, an increase in oil rent volatility leads to an increase in government expenditure as a percentage of GDP in OPEC countries. In contrast, this part of the present section indicates that the response of government budget expenditure components in GDP to a positive shock of oil rents volatility is constant.

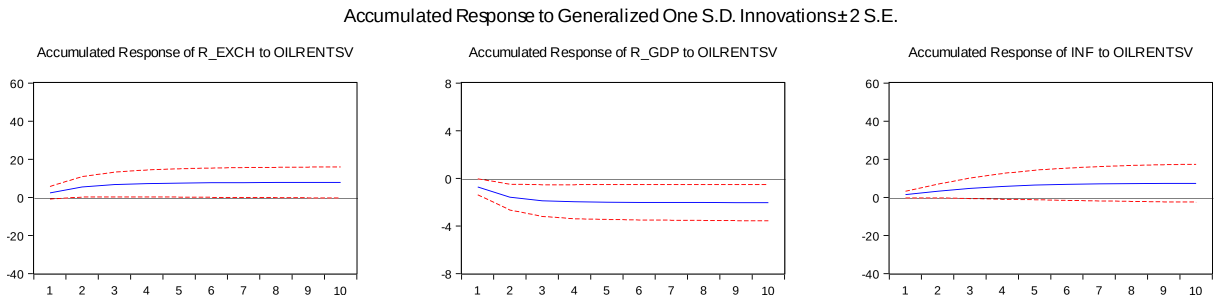
Therefore, it is concluded that an increase in oil rent volatility in OPEC countries leads to an increase in government expenditure as a percentage of GDP, which is not related to the increasing or sustaining of education, military or health expenditure. Nevertheless, other components of government expenditure, such as welfare expenditure or social expenditure and or other budget lines (such as subsidies, profit and interest payments on domestic and foreign loans or unforeseen credits), will increase and subsequently expand the budget's share of GDP. The oil rents directly affect the added value of oil industries. Therefore, the government will increase welfare and social expenditure when there is an increase in oil rent volatility, which imposes unpalatable economic conditions on the oil industries in order to support workers or even the employers in this sector. As it was mentioned in the previous chapter, the effects of oil rents on OPEC countries occur within the short term; therefore, the government performance works only in short-term periods and they return to a normal situation in the medium-term.

Figure 6.9. Cumulative generalised impulse responses of oil rents volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rent volatility, HEALTH_EXP= health expenditure

6.2.2 Non-OPEC countries analysis

This study will start its analysis by concentrating on the impulse responses results based on the full sample of non-OPEC countries. The results are shown within Fig. 6.10 to Fig. 6.18 for the oil price volatility (OilV), oil revenue volatility (OilrevenueV) and oil rents volatility (OilrentsV), respectively.

6.2.2.1 Oil price volatility

The direct and indirect results of oil price volatility and the effect on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP) are reported in Figs. 6.10, 6.11 and 6.12.

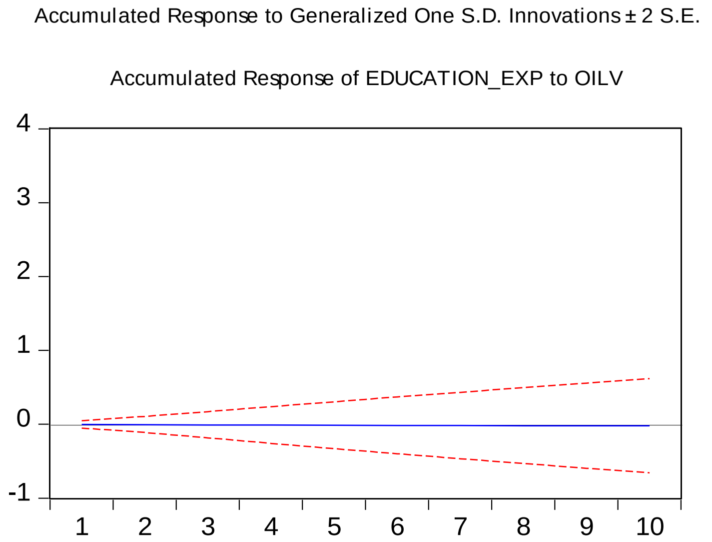
6.2.2.1.1 <u>Education expenditure</u>

It was indicated in the previous chapter that the response of government expenditure as a percentage of GDP to a positive shock of oil price volatility is positive in non-OPEC countries (see PGIRFs of Appendix C.10). However, the results of the present section suggest that OilV does not exert any significant direct or indirect effect on Education_EXP, suggesting that when oil price uncertainty increases this leads to no change in education expenditure as a percentage of GDP. GDP has declined in response to oil price volatility; therefore, the constant share of education expenditure suggests that it is an absolute value in the government budget.

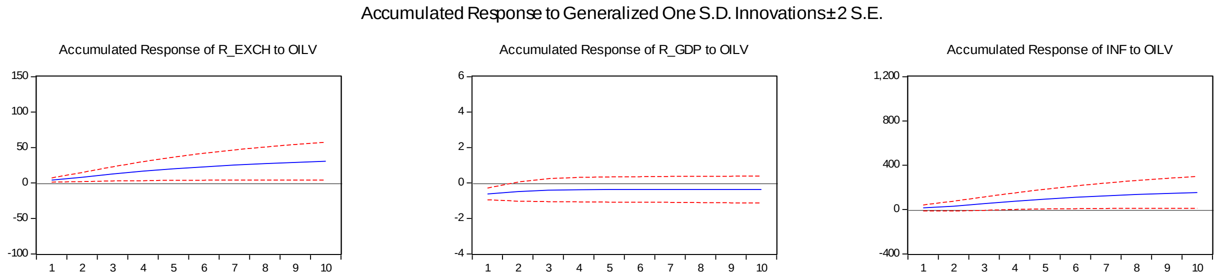
According to the results of the previous chapter, which indicate that higher oil price volatility leads to higher government expenditure as a percentage of GDP, which means that the other components of the government budget (except for education expenditure) will increase or remain fixed.

Figure 6.10. Cumulative generalised impulse responses of oil price volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



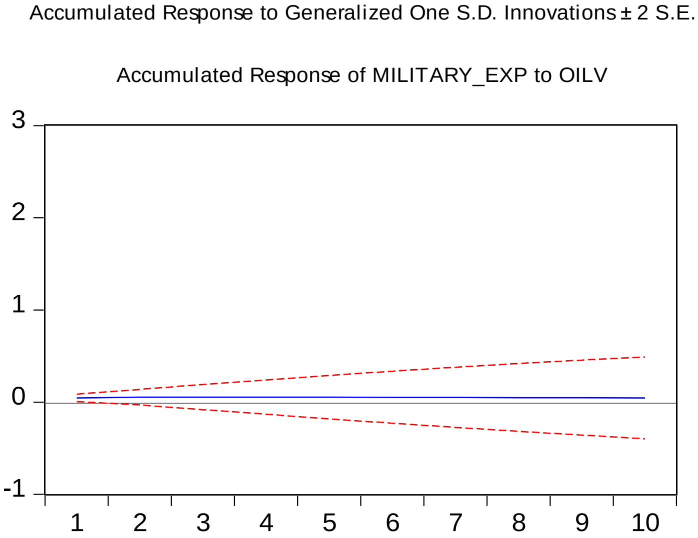
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, EDUCATION_EXP= education expenditure

6.2.2.1.2 Military expenditure

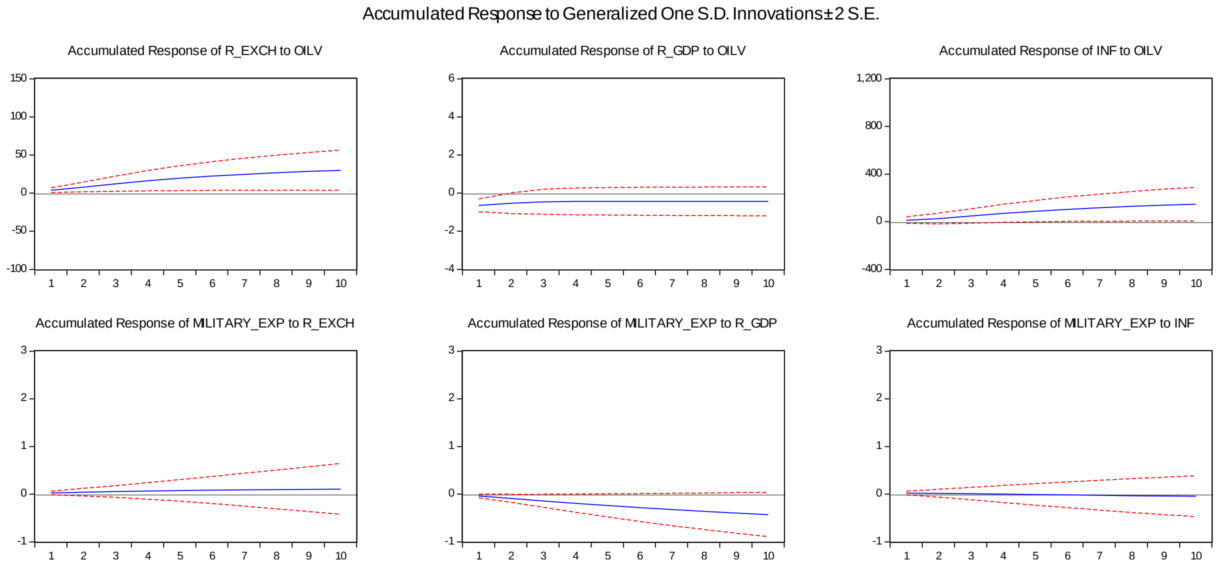
In Figure 6.11, the results indicate that the impact of a standard deviation of a positive shock to oil price volatility leads to an increase in the share of military expenditure in non-OPEC countries (see PGIRFs of Appendix C.11). As expected, one of the budget components does not decrease. Moreover, it is observed that an increase in oil price volatility leads to a decline in economic growth, and, in turn, leads to an increase in the share of military expenditure. The plausible explanation is that there is sticking to military expenditure in the government budget in the event of oil price uncertainty and negative economic growth. It makes the government keep these expenses relatively stable in relation to other budget components; therefore, other budget components will be reduced. The economic reasons will be similar to the previous ones. In general, there is a positive effect of oil price volatility on the share of military expenditure.

Figure 6.11. Cumulative generalised impulse responses of oil price volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, MILITARY_EXP= military expenditure

6.2.2.1.3 __Health expenditure__

According to the results in Fig. 6.12, it is observed that increasing oil price volatility does not lead to any direct change in the share of health expenditure in these countries (see PGIRFs of Appendix C.12). In contrast, the impact of oil price volatility on other variables show that a positive shock to OilV has a positive effect on the R_EXCH and INF and negatively impacts R_GDP. Moreover, the higher OilV leads to higher R_EXCH in non-OPEC countries. However, the higher R_EXCH leads to lower health expenditure as a percentage of GDP. It can be stated that the exchange rate channel leads to a negative influence. The increased exchange rate may increase other components of the government budget such as military expenditure; therefore, the government reduces the absolute value of health expenditure. A possible explanation can be attributed to the reduction of health expenditure in the government budget due to increasing the other expenditures, such as military expenditure caused by an increasing exchange rate (for instance, an increasing exchange rate leads to a more costly imports of weapons). Additionally, if an increase in the exchange rate leads to a GDP increase, together with health expenditure (e.g. increasing medicine imports and social security expenditures caused by a devaluation of the national currency), but if the increase in GDP is greater than the increase in health expenditure, then the ratio of health expenditure as a percentage of GDP will decline.

This study further observes the indirect effects of an OilV shock to Health_EXP, via the R_GDP channel. It is observed that higher oil price uncertainty leads to a reduction in economic growth, and this lead, in turn, to an increase in the share of health expenditure. Since health and healthcare service expenditure cannot be seen as inferior goods, health expenditure remains fixed, but it appears to increase through this channel as a result of a decline in GDP.

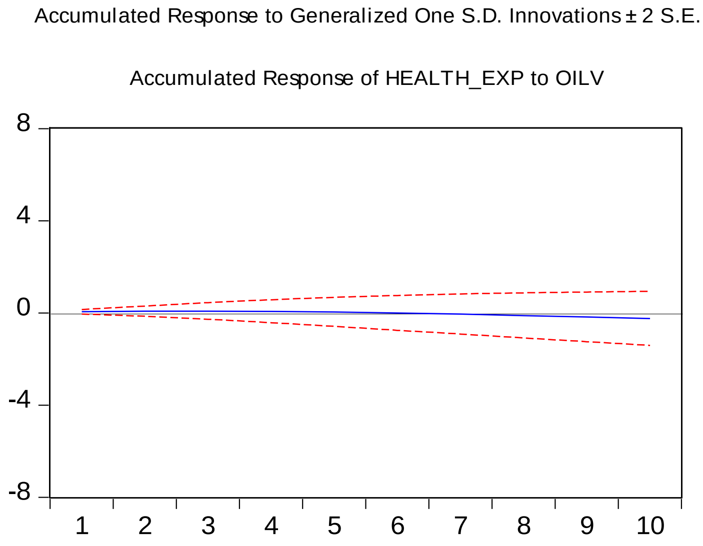
This study also observes the indirect effect of OilV shock to Health_EXP, via the inflation channel. Figure 6.12 illustrates that a positive shock to OilV leads to an increase in INF. The increase in inflation will lead to a decrease in the share of health expenditure as a percentage of GDP.

If the increasing general level of prices leads to an increased price of goods and services that is greater than the price of health services, then an increased inflation rate may lead to a decline in the share of health expenditure as a percentage of GDP through the inflation channel.

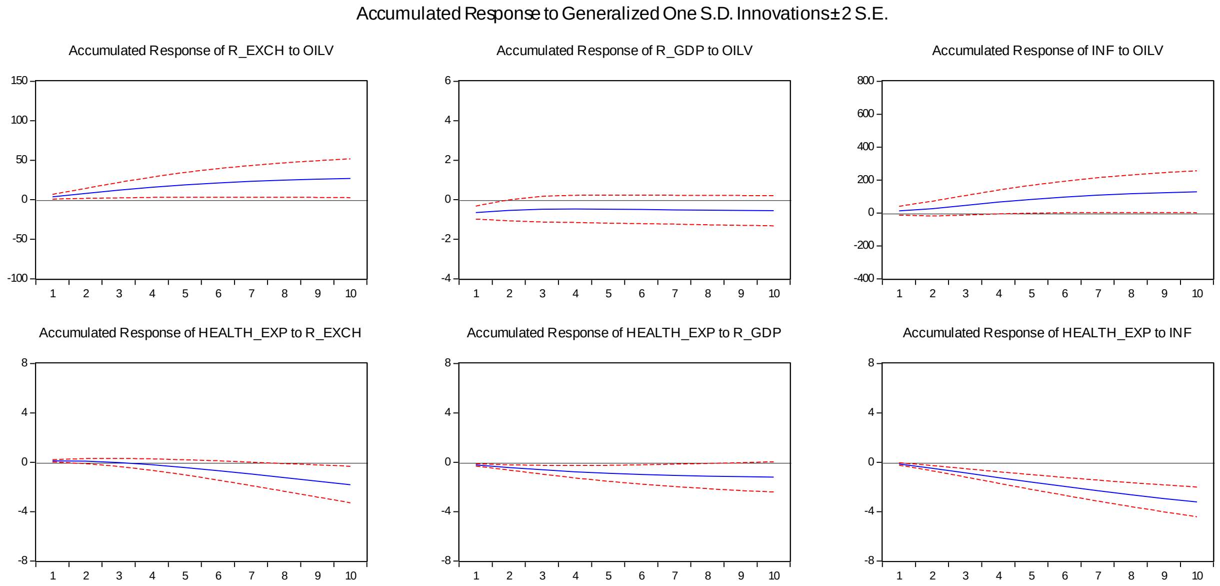
In general, the final effect of oil price volatility on the share of health expenditure is neutral in these countries, so that the health expenditure will remain constant.

Figure 6.12. Cumulative generalised impulse responses of oil price volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, HEALTH_EXP= health expenditure

6.2.2.2 Oil revenue Volatility

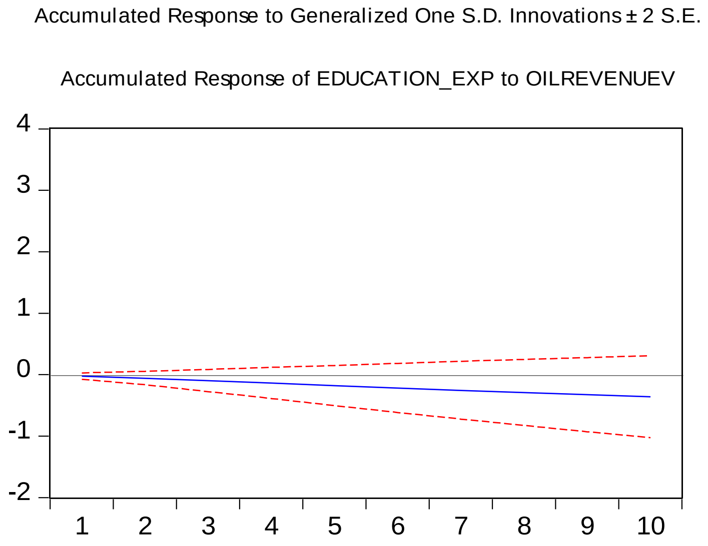
This study evaluates the direct and indirect effect of oil revenue volatility on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP) in non- OPEC countries. Results are demonstrated in Figs. 6.13, 6.14 and 6.15.

6.2.2.2.1 Education expenditure

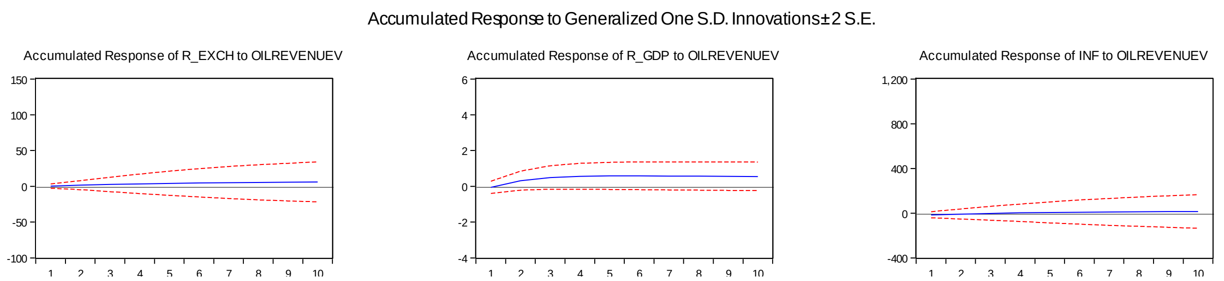
According to the findings of the previous chapter, the economic indicators and the share of government expenditure does not respond significantly to a positive shock of oil revenue volatility in non-OPEC countries (see PGIRFs of Appendix C.13). This part of the present chapter shows that an increase in oil revenue uncertainty does not exert any significant direct or indirect effect on Education_EXP in non-OPEC countries. The relevant reasons were also discussed in the previous chapter.

Figure 6.13. Cumulative generalised impulse responses of oil revenue volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



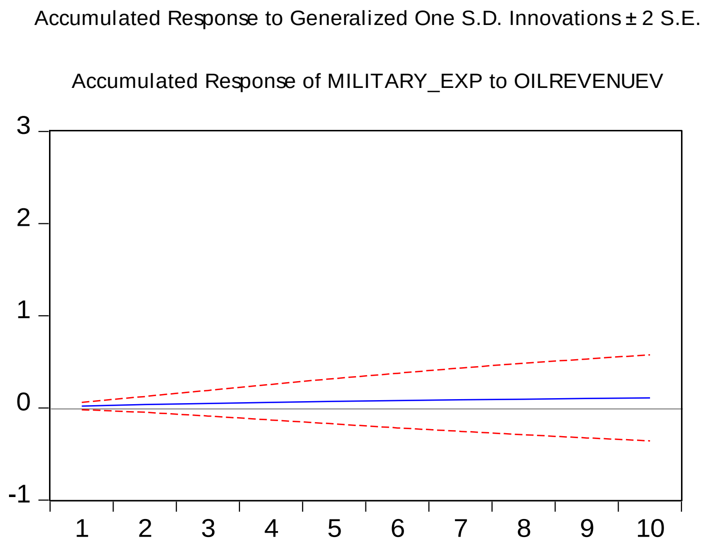
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILV= oil price volatility, EDUCATION_EXP= education expenditure

6.2.2.2.2 Military expenditure

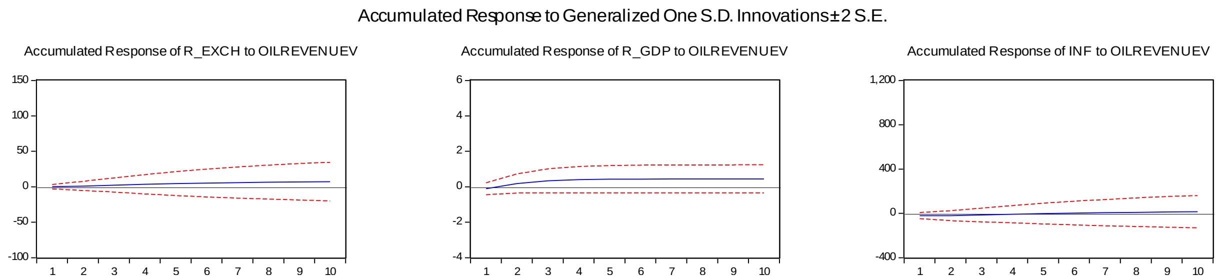
As was mentioned, the oil revenue volatility does not affect economic growth; inflation and exchange rate in non-OPEC countries (see PGIRFs of Appendix 6.14). It is proved that an increase in oil revenue uncertainty does not lead to any change in military expenditure as a percentage of GDP. Therefore, the absolute value of military expenditure remains fixed. The economic reasons for this phenomenon were discussed in the previous chapter.

Figure 6.14. Cumulative generalised impulse responses of oil revenue volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



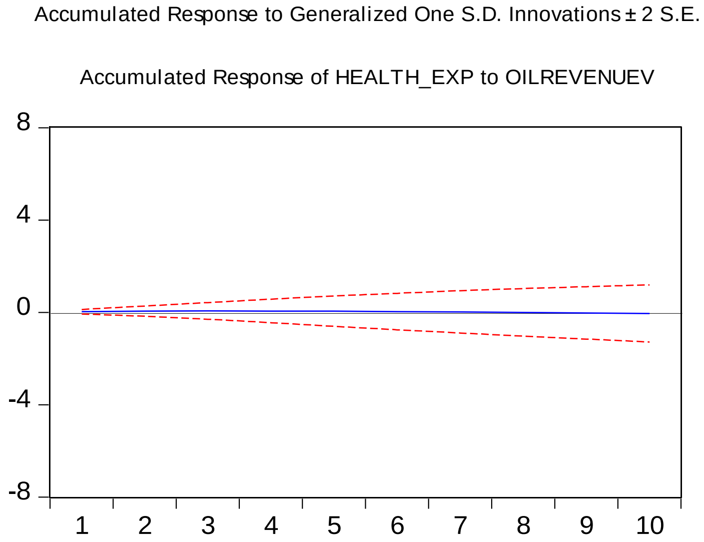
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, MILITARY_EXP= military expenditure

*6.2.2.2.3 **Health expenditure***

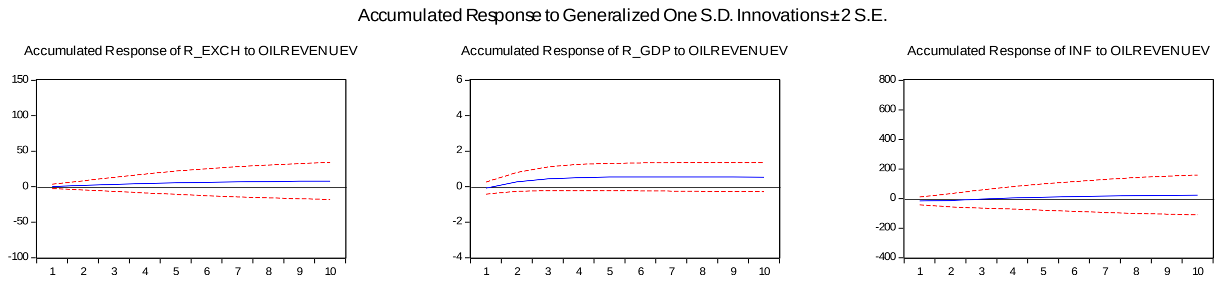
It is also observed that the health expenditure as a percentage of GDP does not respond to oil revenue uncertainty directly or indirectly in non-OPEC countries (see PGIRFs of Appendix C.15). This result is matched with the results in the previous chapter.

Figure 6.15. Cumulative generalised impulse responses of oil revenue volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, HEALTH_EXP= health expenditure

6.2.2.3 Oil rent volatility

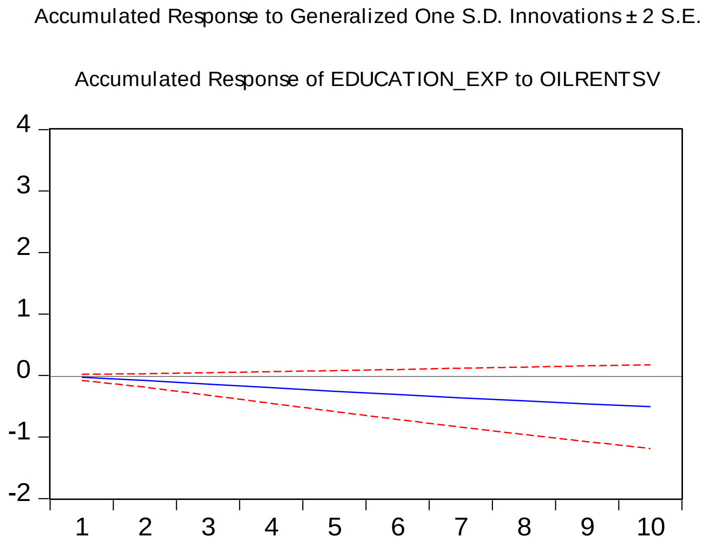
Finally, this study proceeds with the PVAR results based on the direct and indirect effect of oil rents volatility on education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) in non-OPEC countries, which are provided in Figs. 6.16, 6.17 and 6.18.

6.2.2.3.1 <u>Education expenditure</u>

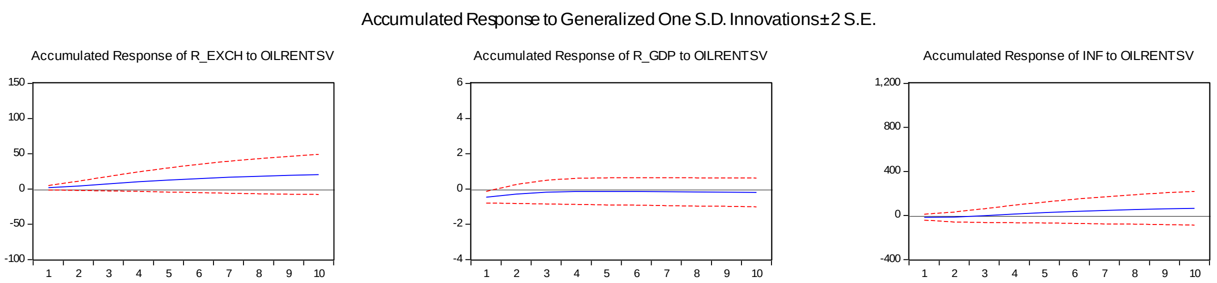
The obtained results in the previous chapter showed that an increase in oil rent volatility leads to an increase in GDP of non-OPEC countries, and this occurs through the direct or indirect (income channel) effects of rising oil rents uncertainty (see PGIRFs of Appendix C.16). As is seen in Fig. 6.16, an increase in oil rents volatility does not have a significant effect on Education_EXP as a percentage of GDP in the budget of these countries.

Figure 6.16. Cumulative generalised impulse responses of oil rents volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



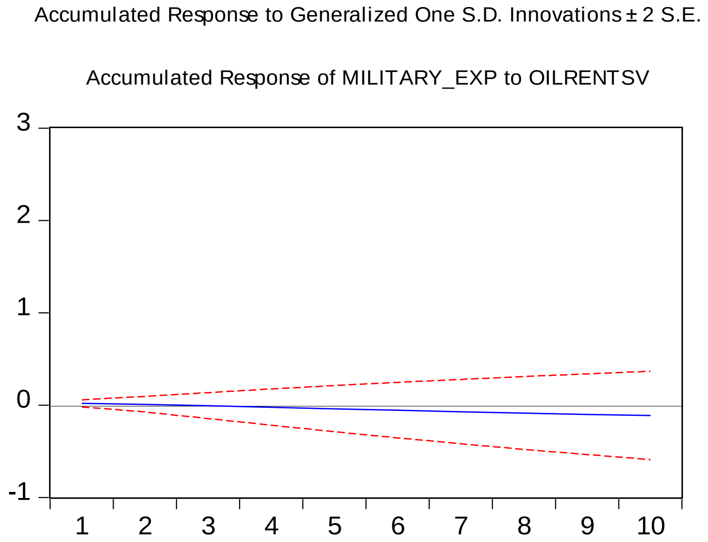
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, EDUCATION_EXP= education expenditure

*6.2.2.3.2 **Military expenditure***

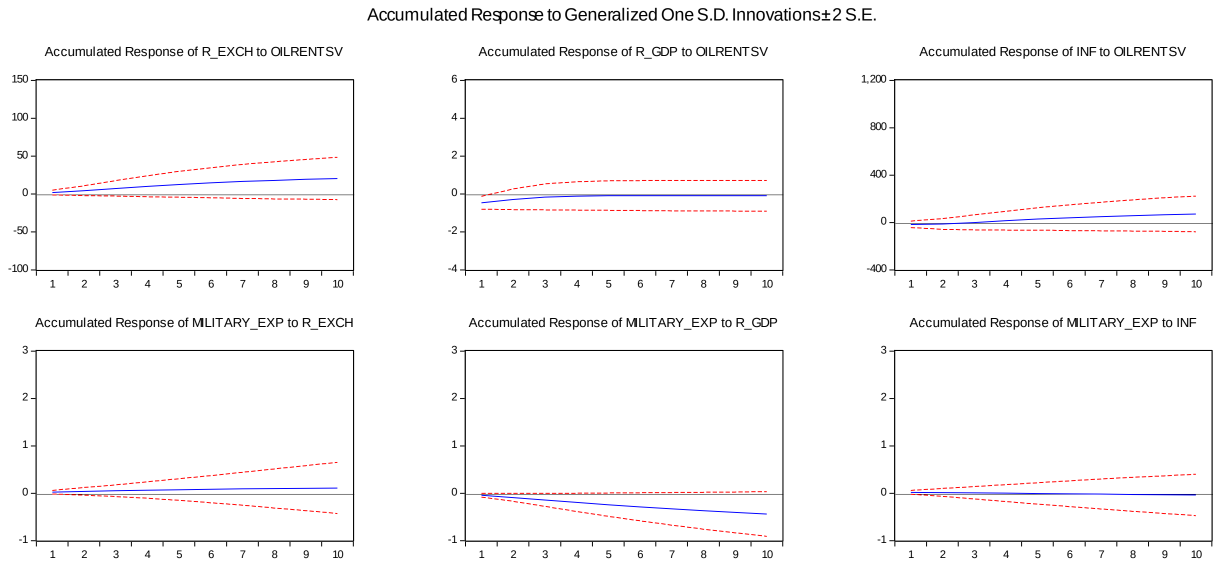
The findings from Fig. 6.17 indicate that an increase in oil rent uncertainty does not lead to any significant change in Military_EXP as a percentage of GDP through a direct channel in non-OPEC countries (see PGIRFs of Appendix C.17). However, there is an indirect channel by which OilrentsV impacts Military_EXP. These effects are propagated via the effects of OilrentsV on R_GDP. The results show that OilrentsV on R_GDP is negative in non-OPEC countries, and the subsequent reduction in economic growth will lead to an increased share of military expenditure as a percentage of GDP due to a greater commitment to military expenditure. Nevertheless, the military, defence and security expenditures are public goods that should be provided by governments so that it is not possible to ignore them. Moreover, the institutional structures, pressure groups and the powerful will respond to any reduction in military expenditure, which increases the commitment to it.

Figure 6.17. Cumulative generalised impulse responses of oil rents volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, MILITARY_EXP= military expenditure

6.2.2.3.3 Health expenditure

Finally, in Fig. 6.18, the effects of a positive shock to oil rent volatility has been shown in non-OPEC countries (see PGIRFs of Appendix C.18). As it can be seen, the response of health expenditure to a positive shock of oil rent volatility is positive via the direct channel. However, health expenditures are allocated by the governments to produce public goods and may be sticky. The finding from Fig. 6.18 shows that a higher OilrentsV leads to a lower R_GDP in this group of countries. On the other hand, health expenditure as a percent of GDP will increase even if it is not reduced by as much as the GDP reduction.

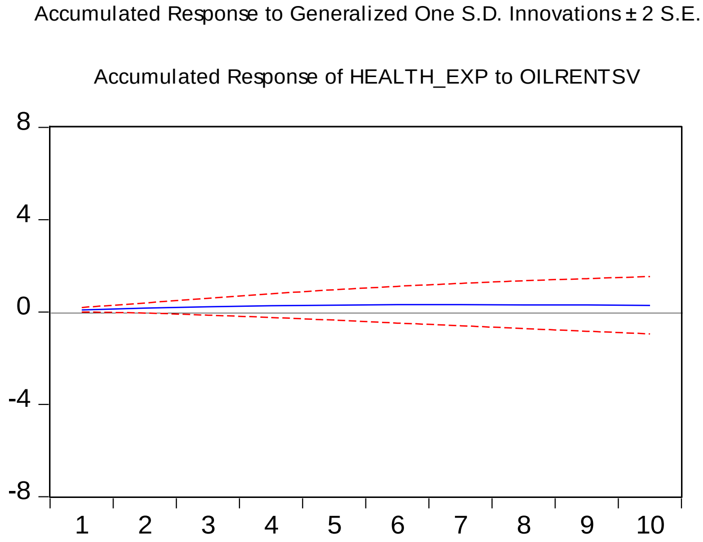
As it is seen, a reduction in GDP leads to an increase in the share of health expenditure (owing to the negative relationship between the share of health expenditure and GDP). This result proves the absolute value of health expenditure in the government budget is sticky and it is not moving in conjunction with any change in GDP.

This study further observes the indirect effects of OilrentsV shock to Health_EXP, via the R_EXCH channel. As it was mentioned in the oil price volatility section, there is an increase in the exchange rate, which increases government expenditure. Therefore, government can reduce health expenditure. It is, therefore, not unexpected that the health expenditure as a percentage of GDP will fall.

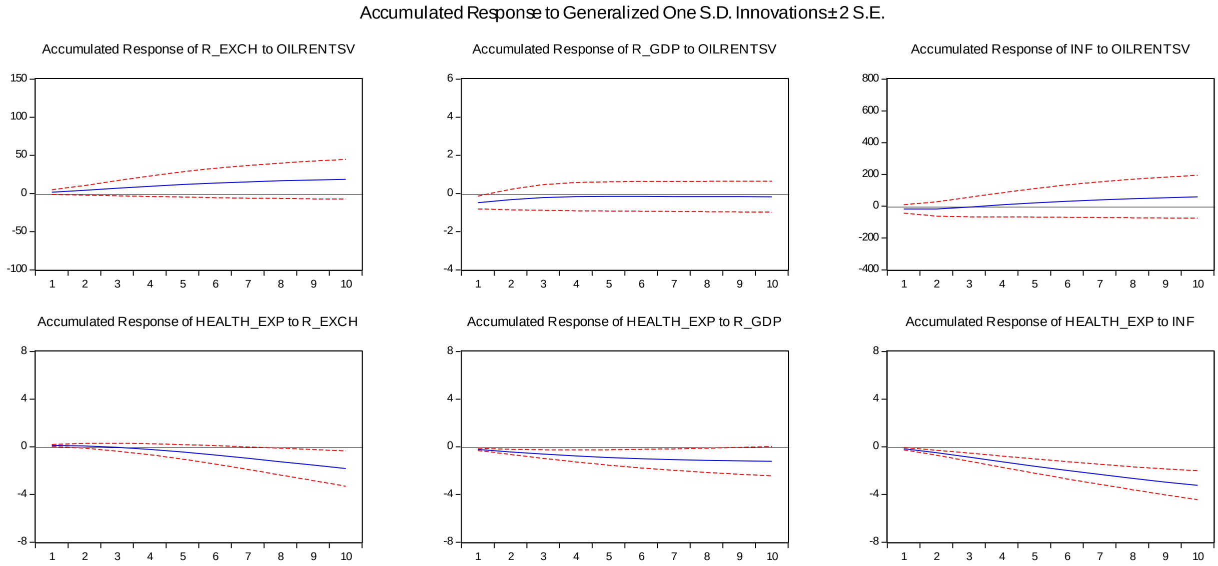
In general, these two indirect effects positively influence the share of health expenditure.

Figure 6.18. Cumulative generalised impulse responses of oil rents volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rent volatility, HEALTH_EXP= health expenditure

6.2.3 Overall comparison between OPEC/non-OPEC countries

The direct and indirect effect of the studied oil volatility indicators on education expenditure (Education_EXP) in two groups of OPEC and non-OPEC countries are reported in Table. 6.1.

This table shows that an increase in oil uncertainties in OPEC countries does not lead to any significant change in education expenditure as a percentage of GDP. However, GDP will decline in these countries due to the fact that the effect of oil volatility on their economic growth is negative. In general, the results show that the response of education expenditure to the uncertain oil indicators, such as cost components, are ignored in both OPEC and non-OPEC countries and this is common in non-OPEC countries.

Table 6.1. The effect of oil volatility on education expenditure as a percentage of GDP

	OPEC	**Non-OPEC**
Oil price volatility	No effect	No effect
Oil revenue volatility	No effect	No effect
Oil rents volatility	No effect	No effect

Table 6.2 reports the effect of oil volatility shocks on the share of military expenditure in two groups of countries under study. The key point is the different effects of three oil volatility indicators on military expenditure as a percentage of GDP in OPEC countries. Increase in oil price volatility leads to a reduction in military expenditure as a percentage of GDP of these countries, and it can be stated that higher oil price volatility leads to lower military expenditure as a percentage of GDP, and also increased oil price volatility does not have an effect on the economic indicators of OPEC countries. Therefore, lower military expenditure does not depend on their domestic economy. In fact, an increase in oil revenue volatility leads to a rise in the share of military expenditure in these countries. The reason for that may be related to the stickiness of military expenditure in their budget, so that military expenditure will not be reduced due to a GDP reduction. On the other hand, there is no significant change in the share of military expenditure in responding to oil rent volatility; therefore, any GDP reduction will be met by an equal reduction in military expenditure. As it was mentioned earlier, the oil rent depends on the oil production costs in these countries and has short-term effects when compared to oil revenue volatility. In non-OPEC countries, the share of military expenditure will be increased in responding to oil price volatility, and oil rents volatility, while oil revenue volatility has no effect. It was also debated that oil revenue volatility has no effect on the economic indicators in non-OPEC countries and the relevant reasons were discussed.

In general, military expenditure have a higher degree of stickiness in relation to oil volatility and there is little adjustment in non-OPEC countries. On the contrary, military expenditures are more heterogeneous in responding to oil volatility in OPEC countries and it can be stated that oil price volatilities are out of their control.

Table 6.2. The effect of oil volatility on military expenditure as a percentage of GDP

	OPEC	Non-OPEC
Oil price volatility	Negative	Positive
Oil revenue volatility	Positive	No effect
Oil rents volatility	No effect	Positive

Table 6.3 indicates the effect of oil volatility on health expenditure; it is seen that an increase in oil revenue and rent volatility on health expenditure do not change in OPEC countries, which shows the same reduction in absolute value of this variable together with GDP.

In terms of oil price volatility, the share of health expenditure is increased, which is not related to their domestic economy because it seems out of their control (such as global rising medicine costs). The results are different in non-OPEC countries. Although oil revenue volatility is inconsequential in these countries, the positive shock of oil price volatility has an indirect effect on the share of health expenditure. These effects neutralize the other effects. Finally, the oil rents volatility has a positive effect on the health expenditure due to the higher effect of oil rents volatility on their GDP.

Table 6.3. The effect of oil volatility on health expenditure as a percentage of GDP

	OPEC	Non-OPEC
Oil price volatility	Positive	No effect
Oil revenue volatility	No effect	No effect
Oil rents volatility	No effect	Positive

6.3 Panel generalised impulse response functions: high and low volatility regimes

In this section, this research will analyse the robustness of the results by means of estimating previous specifications of the PVAR for high and low oil volatility regimes. More detailed discussed in chapter 5 (5.3).

6.3.1 OPEC countries analysis

Next, we estimate the PVAR models separately for oil high and low oil volatility regimes in OPEC countries. The results are shown from Fig. 6.19 to Fig. 6.35 for the oil price volatility (OilV), oil revenue volatility (OilrevenueV) and oil rents volatility (OilrentsV), respectively.

6.3.1.1 Oil price volatility

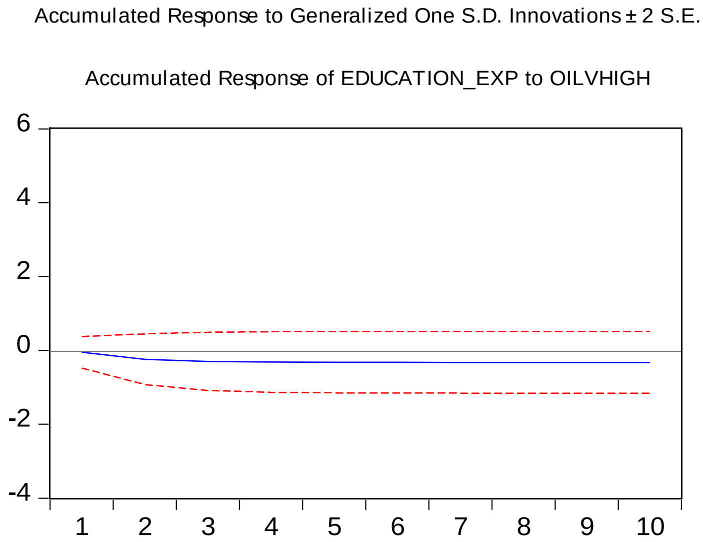
The direct and indirect findings of oil price volatility regimes and the effect on education expenditure (Education_EXP), military expenditure (Military_EXP) and health expenditure (Health_EXP) are shown in Figs. 6.19, 6.20, 6.21, 6.22, 6.23 and 6.24.

6.3.1.1.1 Education Expenditure

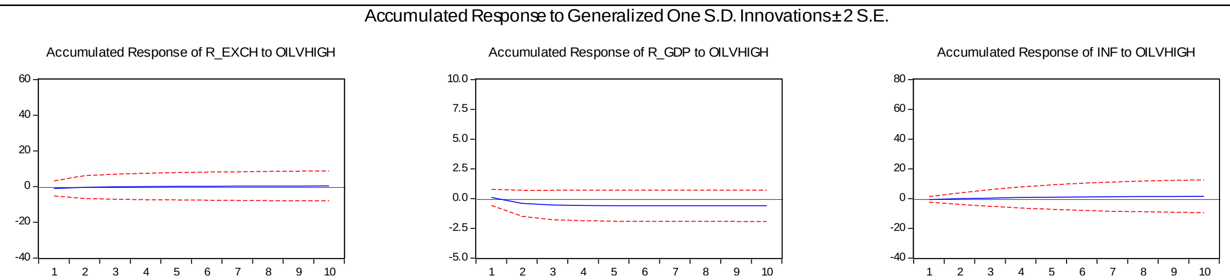
As shown in the panels, oil price high and low volatility regimes and education expenditure in OPEC countries of Figs. 6.19 and 7.20, the OilV regimes still do not impact on Education_EXP of the OPEC countries, which confirm the findings of the PVAR model of the full sample. Therefore, this expenditure does not depend on the oil volatility regime (see Appendixes C.19 and C.20).

Figure 6.19. Cumulative generalised impulse responses of oil price high volatility on education expenditure in OPEC countries

Direct effects



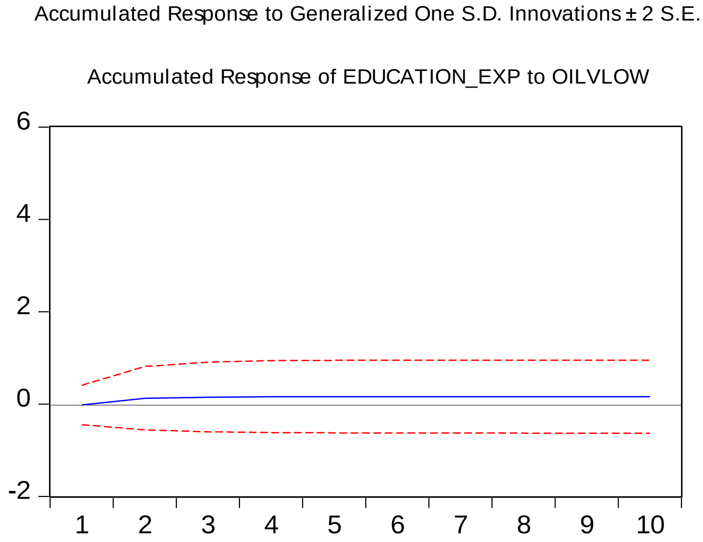
Indirect effects



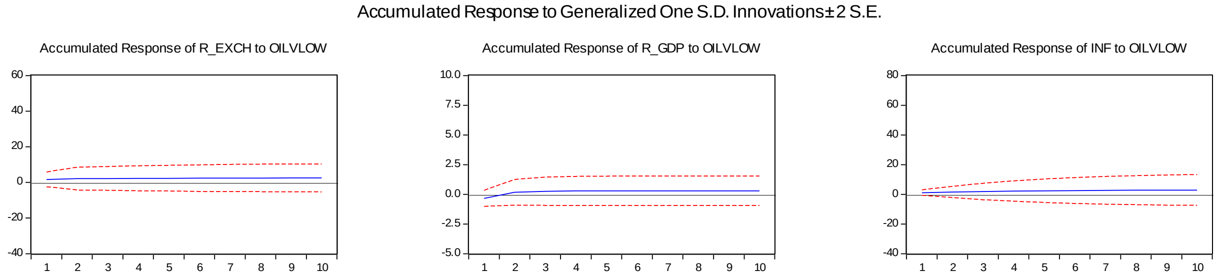
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, EDUCATION_EXP= education expenditure

Figure 6.20. Cumulative generalised impulse responses of oil price low volatility on education expenditure in OPEC countries

Direct effects



Indirect effects



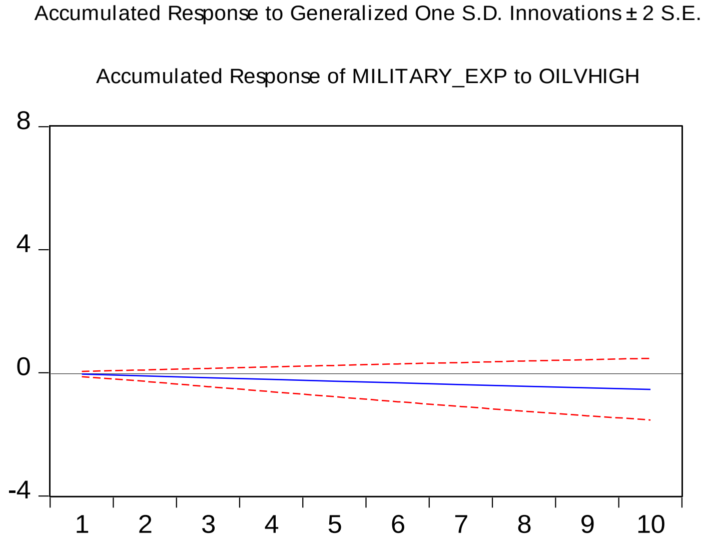
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, EDUCATION_EXP= education expenditure

6.3.1.1.2 Military Expenditure

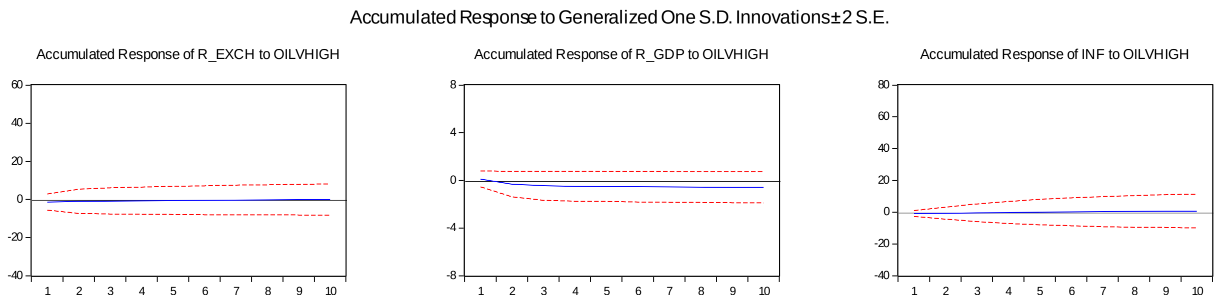
In the high volatility regime, the results from the impulse response functions indicate a similar response of military expenditure of OPEC countries to oil price uncertainty (see Appendixes C.21 and C.22). The only difference is a lack of effect of oil price volatility on military expenditure within the low volatility regime, which indicates an asymmetric effect. According to the hypothesis designed in the previous section of this chapter, it seems that the change in military expenditure of OPEC countries depends on the external changes imposed on them, and not their domestic economic changes due to the lack of the effect of oil price volatility on their economic indicators. It is now seen that an increase in oil price volatility occurs in high volatility regimes. In fact, there is no significant change in the military expenditure of OPEC countries when there is low oil price volatility and a low regime, however, military expenditure will be reduced if there are severe oil price uncertainties and a regime change in the volatility. It was mentioned that military weapon suppliers do not sell military weapons when there is an increase in oil price uncertainty; therefore, military expenditure of OPEC countries will be reduced automatically, which is in line with the result obtained.

Figure 6.21. Cumulative generalised impulse responses of oil price high volatility on military expenditure in OPEC countries

Direct effects



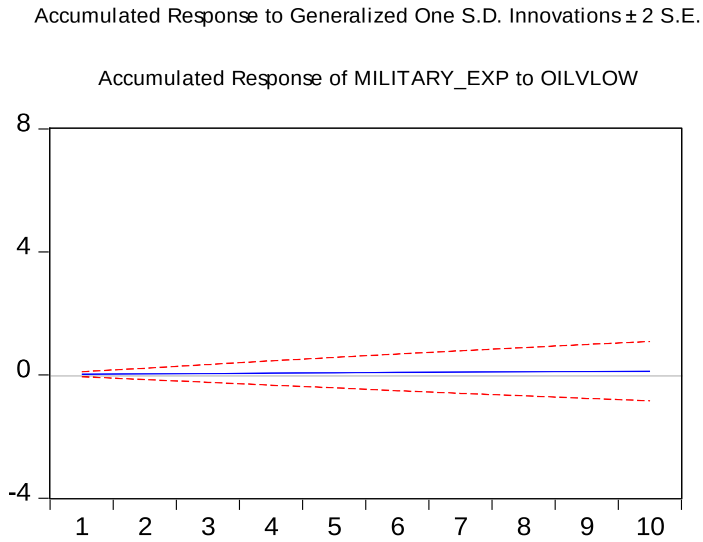
Indirect effects



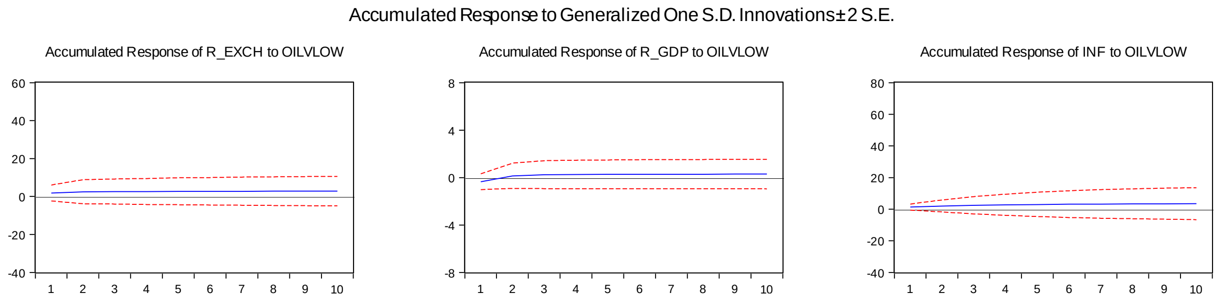
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, MILITARY_EXP= military expenditure

Figure 6.22. Cumulative generalised impulse responses of oil price low volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



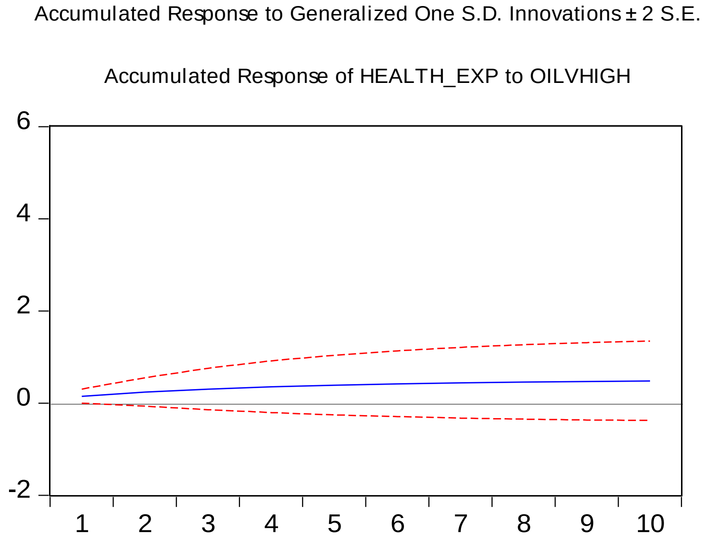
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, MILITARY_EXP= military expenditure

*6.3.1.1.3 **Health Expenditure***

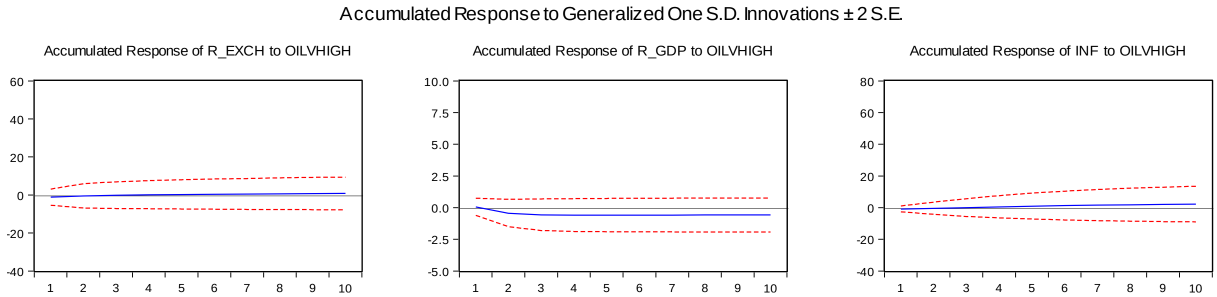
In the case of a share of the health expenditure variable as a percentage of GDP, the positive shocks of oil price volatility within separated volatility regimes has a similar profile to the single-regime state without any change in results (see Appendixes C.23 and C.24). Therefore, the effect of oil price uncertainty on this economic indicator does not depend on oil volatility regimes.

Figure 6.23. Cumulative generalised impulse responses of oil price high volatility on health expenditure in OPEC countries

Direct effects



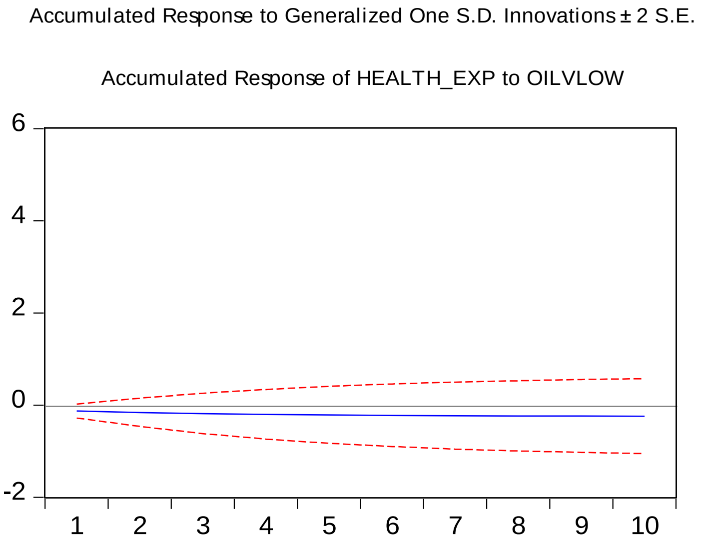
Indirect effects



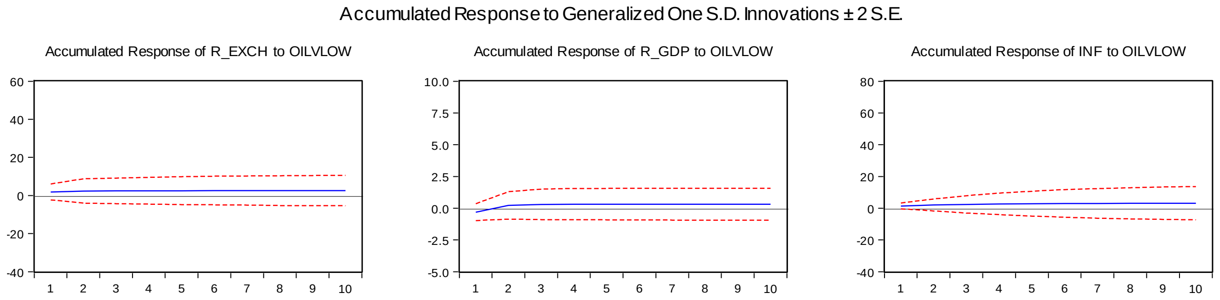
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, HEALTH_EXP= health expenditure

Figure 6.24. Cumulative generalised impulse responses of oil price low volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, HEALTH_EXP= health expenditure

6.3.1.2 Oil revenue volatility

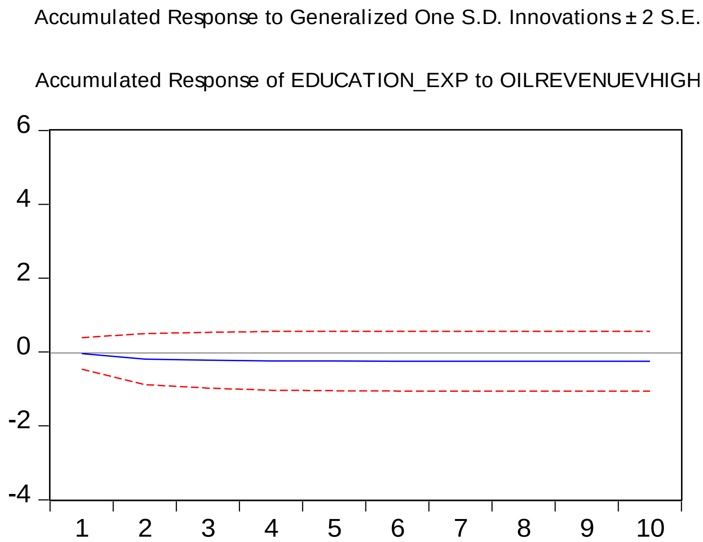
This study will now consider the direct and indirect effects of oil revenue volatility regimes on education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) in OPEC countries. The results are presented Figs. 6.25, 6.26, 6.27, 6.28, 6.29 and 6.30.

6.3.1.2.1 Education expenditure

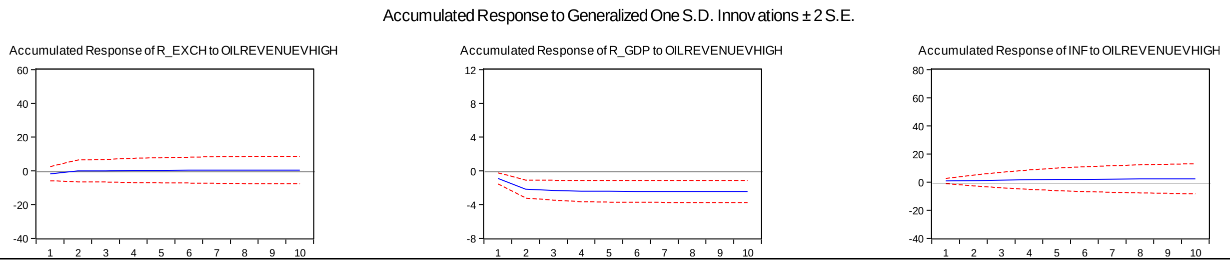
Although the previous results indicated that oil revenue volatilities do not have any effect on the share of education expenditure in OPEC countries, the separation of oil revenue volatility's regimes into two high and low volatility regimes, in this part, have led to similar results to those in a high volatility regime (see Appendixes C.25 and C.26). While in the low volatility regime, the results show that oil revenue uncertainty increases in the share of education expenditure as a percentage of GDP in OPEC countries. In fact, if there is low oil revenue volatility, there will be a positive response of OPEC economies to increasing oil revenue volatility. There will also be a positive response of economic growth to oil revenue volatility in this regime. Therefore, the government increases education expenditure at a higher level than that seen in economic growth, which leads to an increase in the share of education expenditure. This assumes that the volatility that occurred will boost oil revenues when there is a low volatility regime. This result implies non-linear and asymmetric effects.

Figure 6.25. Cumulative generalised impulse responses of oil revenue high volatility on education expenditure in OPEC countries

Direct effects



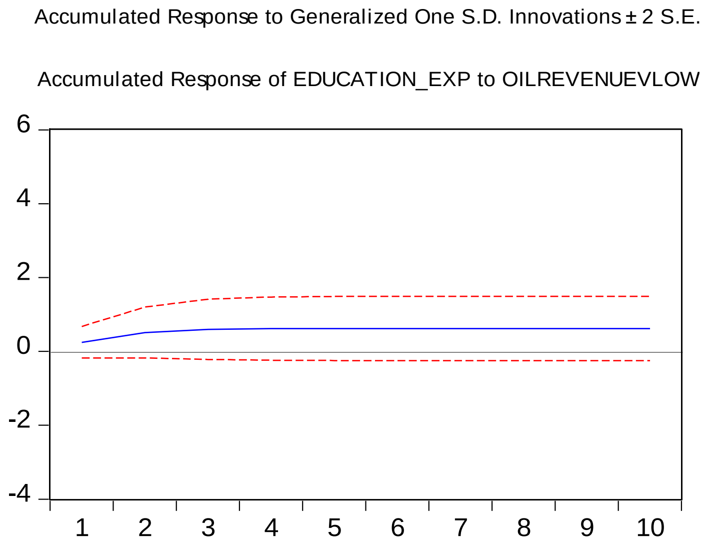
Indirect effects



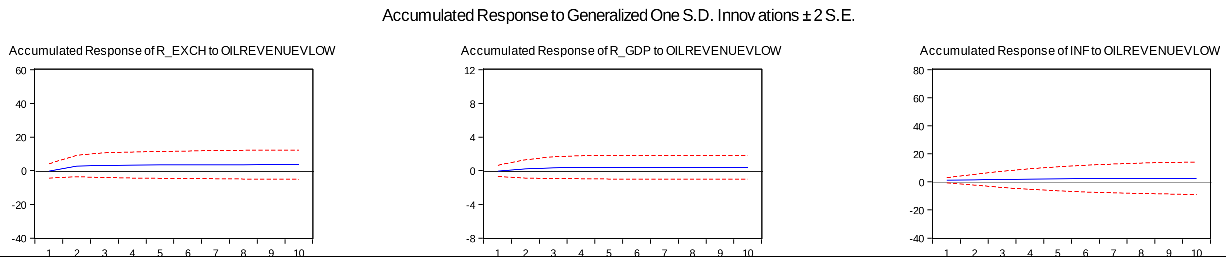
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, EDUCATION_EXP= education expenditure

Figure 6.26. Cumulative generalised impulse responses of oil revenue low volatility on education expenditure in OPEC countries

Direct effects



Indirect effects



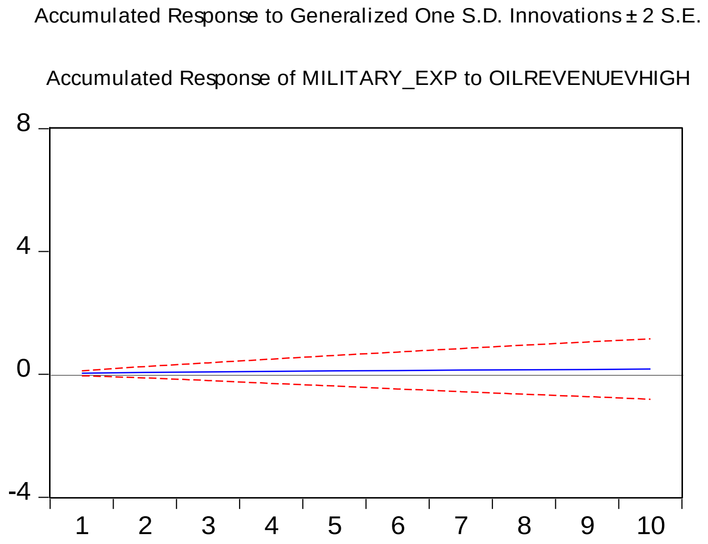
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, EDUCATION_EXP= education expenditure

6.3.1.2.2 Military expenditure

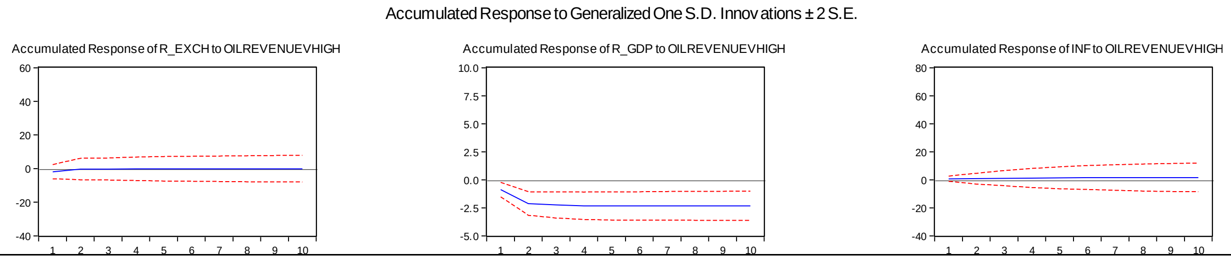
Figures 6.27 and 6.28 present the panel generalised impulse response function for oil revenue high and low volatility regimes on military expenditure in OPEC countries (see PGIRFs of Appendixes C.27 and C.28). In general, this study observes that the separation of oil revenue volatility into two regimes leads to an increase in military expenditure of OPEC countries when there is revenue volatility in the low regime, while the opposite occurs within the high regime. Therefore, there is an asymmetric impact, similar to the results obtained for education expenditure. The assumed positive impact of increasing oil revenue volatility on the amount of oil revenue of OPEC countries leads to a greater share of military expenditure than achieved by economic growth.

Figure 6.27. Cumulative generalised impulse responses of oil revenue high volatility on military expenditure in OPEC countries

Direct effects



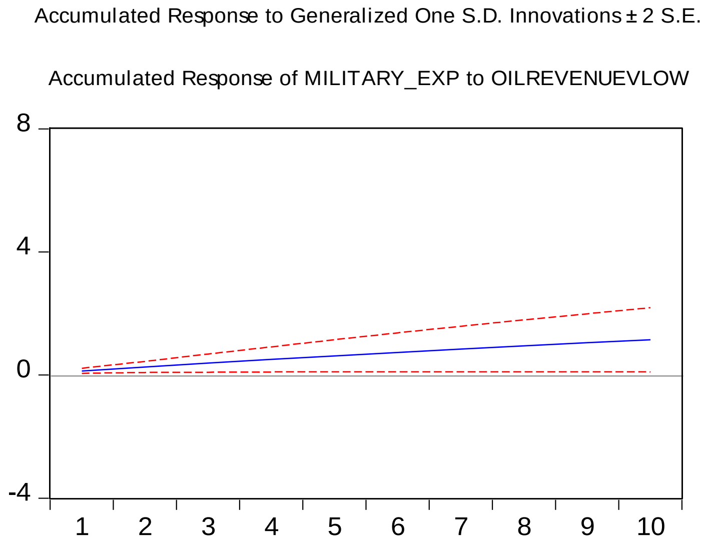
Indirect effects



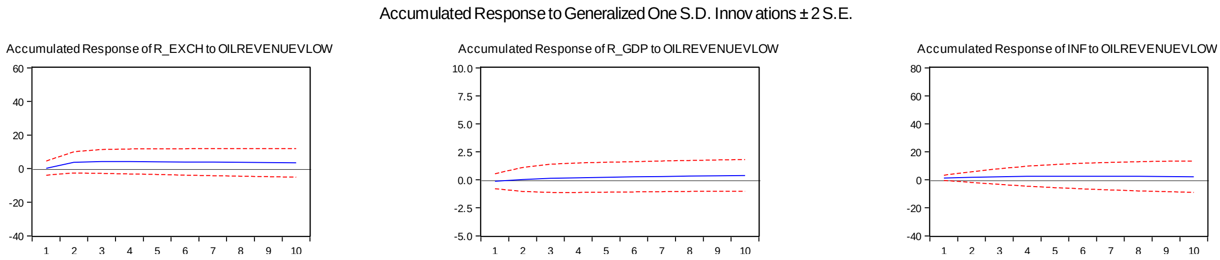
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, MILITARY_EXP= military expenditure

Figure 6.28. Cumulative generalised impulse responses of oil revenue low volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



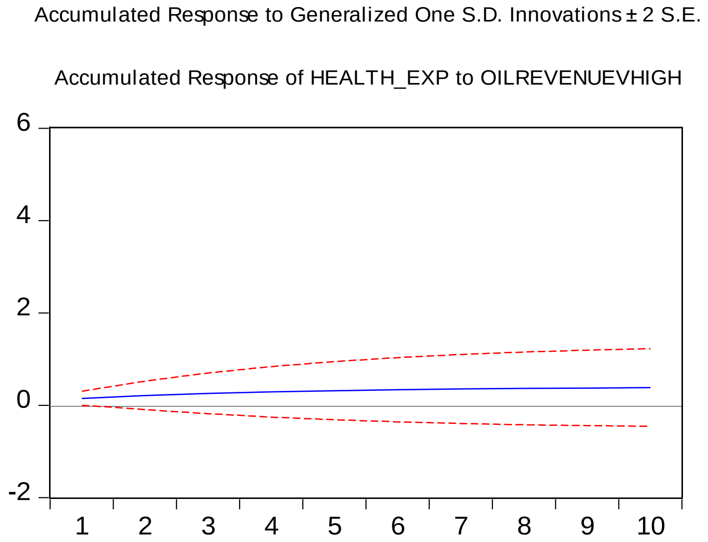
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, MILITARY_EXP= military expenditure

6.3.1.2.3 __Health expenditure__

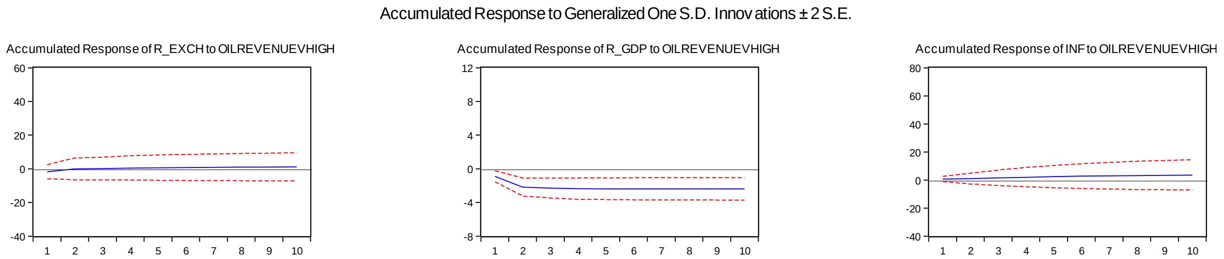
Next, this study focuses on oil revenue high and low volatility on health expenditure in OPEC countries. Findings are shown in Figs. 6.29 and 6.30 (see PGIRFs of Appendixes C.29 and C.30). It can be noticed that the results are similar to those of the previous section in the low volatility regime, while there is a direct effect of oil revenue high volatility on the share of health expenditure in the OPEC countries. This increase in health expenditure occurs if oil revenue volatility in a high volatility regime is in line with the severe negative effect on economic growth, and, therefore, the GDP of these countries. Hence, it can be concluded that GDP will decrease due to severe uncertainty in oil revenue, but as the major part of health expenditure cannot be reduced or ignored, a reduction in health expenditure occurs to a lesser degree than the reduction in GDP. Therefore, the share of health expenditure will be increased in OPEC countries. This result implies an asymmetric response of health expenditure to the oil revenue volatilities.

Figure 6.29. Cumulative generalised impulse responses of oil revenue high volatility on health expenditure in OPEC countries

Direct effects



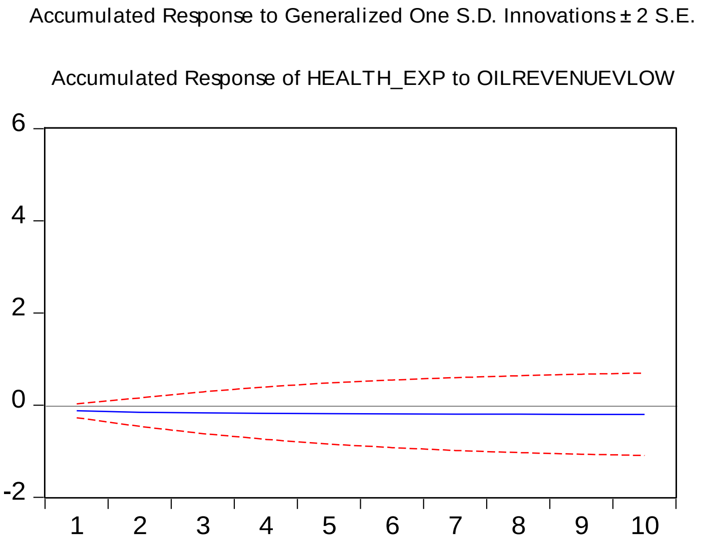
Indirect effects



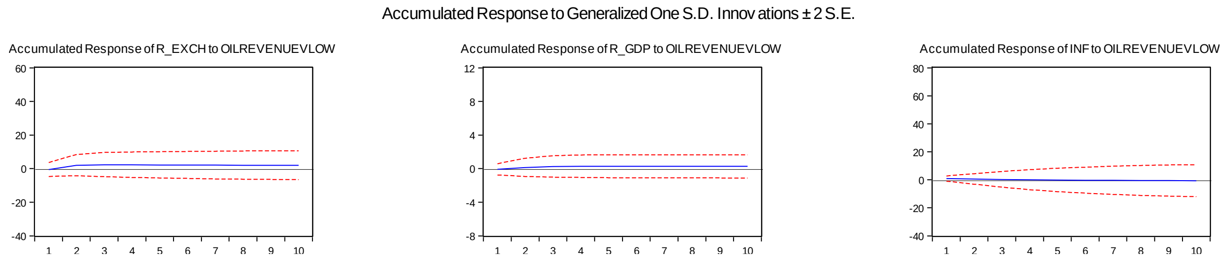
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, Health_EXP= health expenditure

Figure 6.30. Cumulative generalised impulse responses of oil revenue low volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, Health_EXP= health expenditure

6.3.1.3 Oil rent volatility

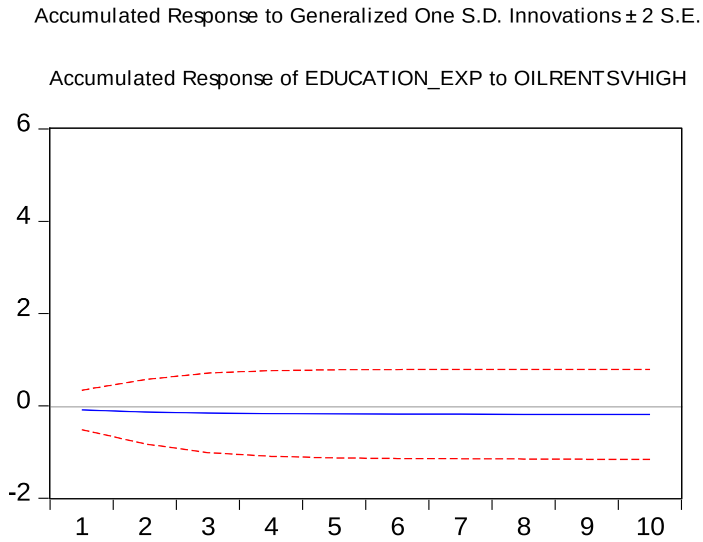
The robustness findings of oil rent volatility regimes and the effect on education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) of the OPEC countries are shown in Figs. 6.31, 6.32, 6.33, 6.34, 6.35 and 6.36.

6.3.1.3.1 <u>Education expenditure</u>

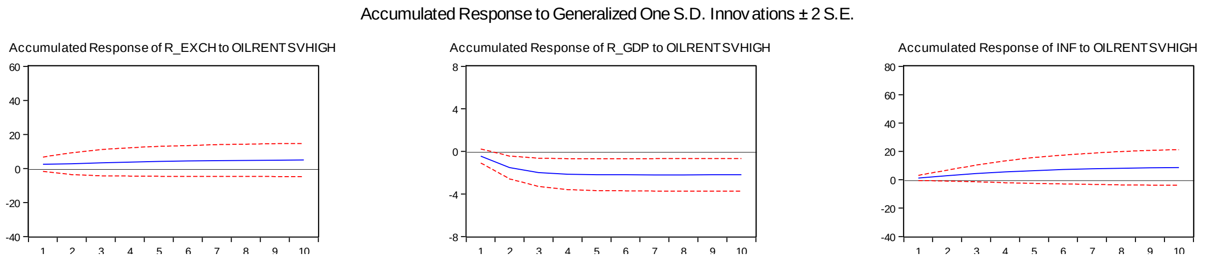
The analysis of the oil rents volatility regimes is displayed in Figs. 6.31 and 6.32. The results show that the OilrentsV regimes still do not impact on Education_EXP in OPEC countries, which confirm the findings of the PVAR method for the full sample (see Appendixes C.31 and C.32).

Figure 6.31. Cumulative generalised impulse responses of oil rent high volatility on education expenditure in OPEC countries

Direct effects



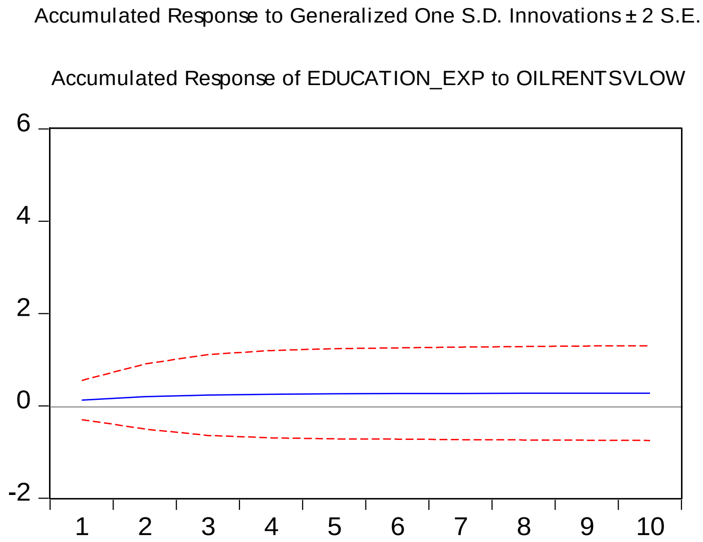
Indirect effects



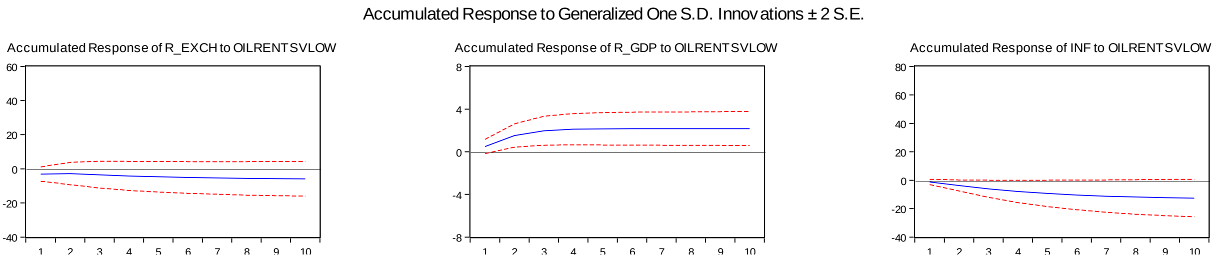
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, EDUCATION_EXP= education expenditure

Figure 6.32. Cumulative generalised impulse responses of oil rent low volatility on education expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, EDUCATION_EXP= education expenditure

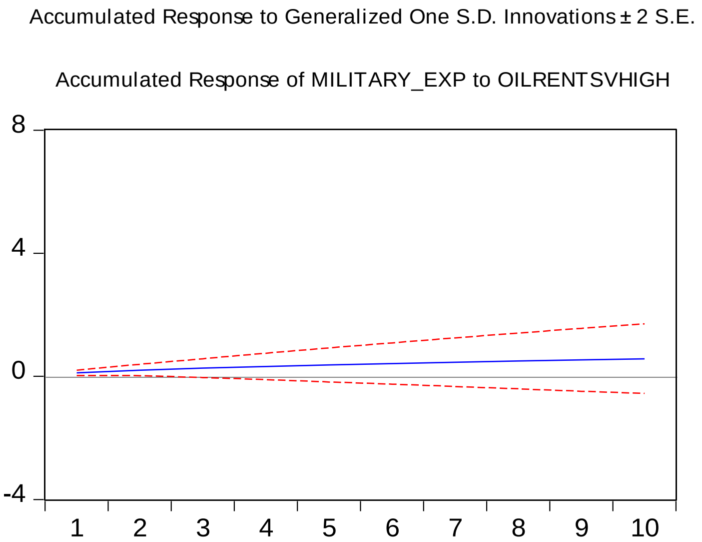
6.3.1.3.2 Military expenditure

The results for oil rent high and low volatility regimes on the direct and indirect effect of Military_EXP in OPEC countries are shown in Figs. 6.33 and 6.34 (see Appendixes C.33 and C.34). Contrary to the share of education expenditure, oil rent high and low volatility regimes have an asymmetric effect on the share of military expenditure. The results obtained from the high volatility regime are similar to the full sample. Nevertheless, it is seen in the low rent volatility regime, similarly to the oil revenue low volatility regime, that increasing oil rent low volatility regime leads to positive economic effects on OPEC countries. Moreover, there is no significant response to the share of military expenditure of the positive shock of the oil rent low volatility regime. Also, as economic growth and GDP will increase due to this shock, the fixed share of military expenditure means an appropriate increase in the absolute value of military expenditure in these countries. In contrast to the high volatility regime, economic growth is reduced while the share of military expenditure is increased.

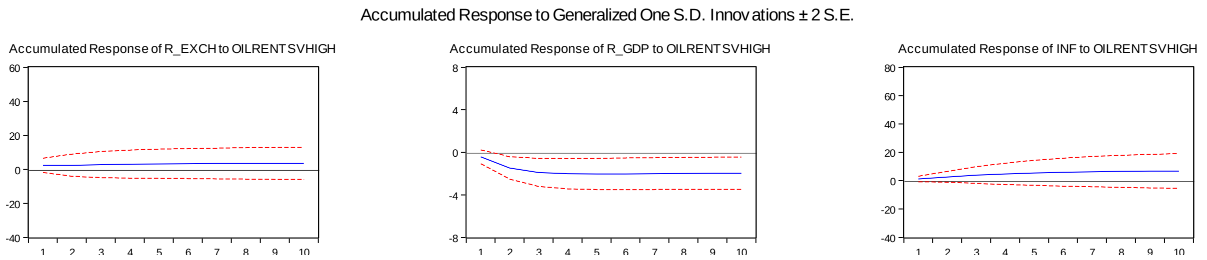
Therefore, such an increasing oil rent low volatility regime has asymmetric effects compared to the high volatility regime.

Figure 6.33. Cumulative generalised impulse responses of oil rent high volatility on military expenditure in OPEC countries

Direct effects



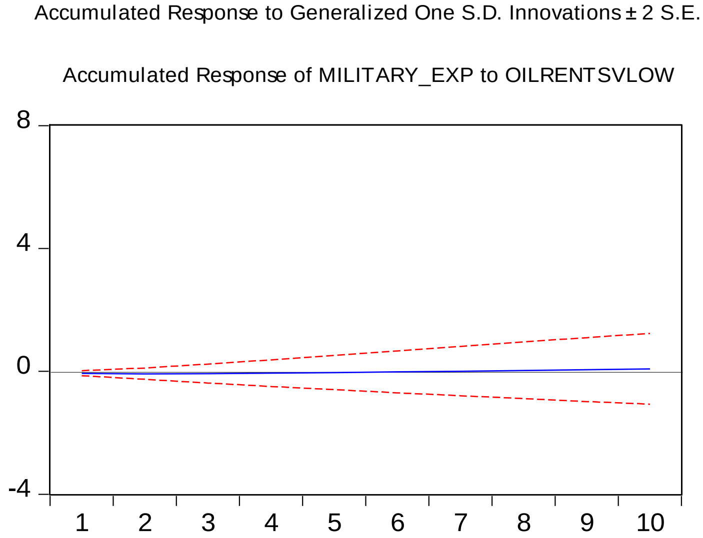
Indirect effects



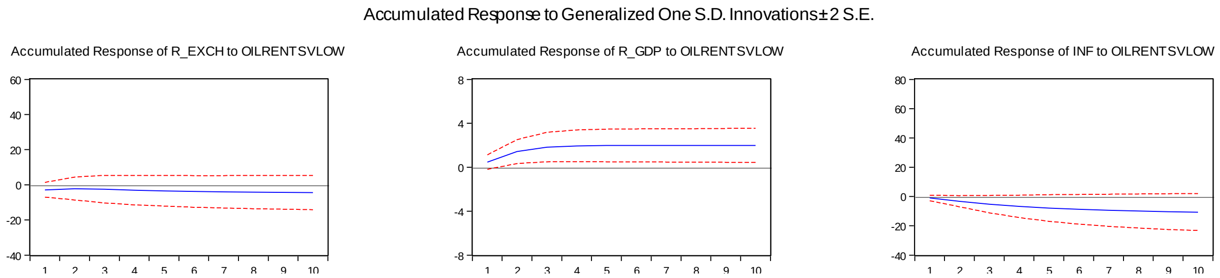
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, MILITARY_EXP= military expenditure

Figure 6.34. Cumulative generalised impulse responses of oil rent low volatility on military expenditure in OPEC countries

Direct effects



Indirect effects



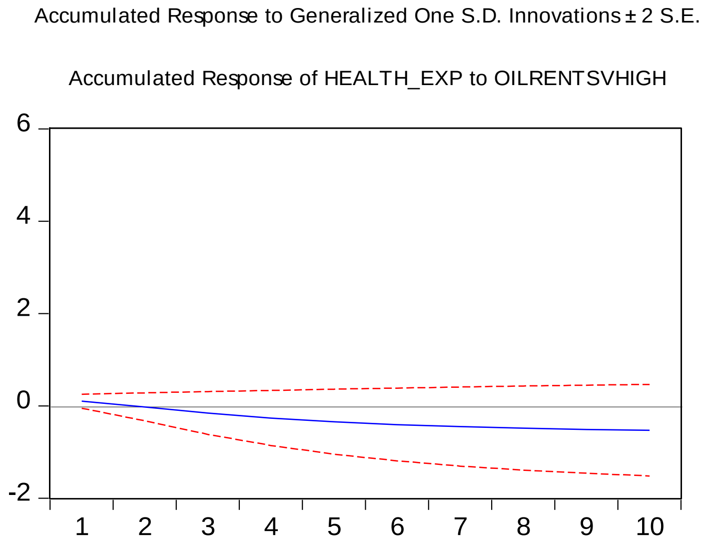
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, MILITARY_EXP= military expenditure

6.3.1.3.3 __Health expenditure__

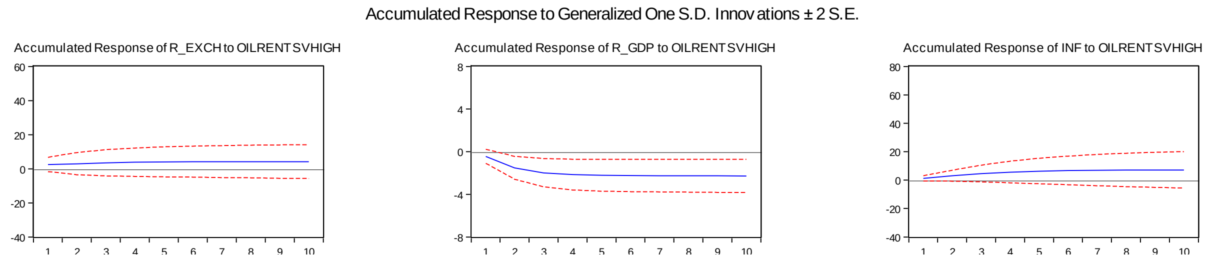
According to the effects of oil rent high and low volatility regimes on the share of health expenditure, and although health expenditure shows a different response to the positive shock of the oil volatility, there is a fixed response to the share of health expenditure as a percentage of GDP within both of the regimes. There is a similar reduction in the absolute value of health expenditure and GDP allied to the fixed health expenditure in the high regime; whilst in the low regime there is similar increase in the absolute value of health expenditure and GDP, and, therefore, a fixed health expenditure. This means a symmetric response of the share of health expenditure to increasing oil rent volatility (see Appendixes 6.35 and 6.36). The possible economic reasons were discussed in the previous section.

Figure 6.35. Cumulative generalised impulse responses of oil rent high volatility on health expenditure in OPEC countries

Direct effects



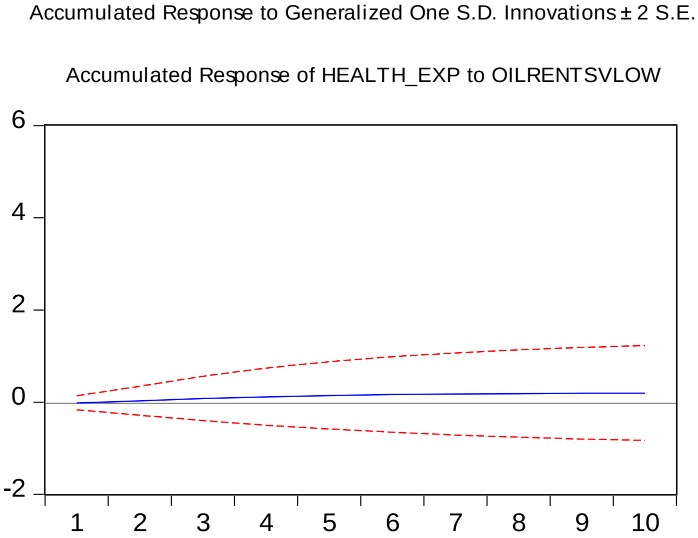
Indirect effects



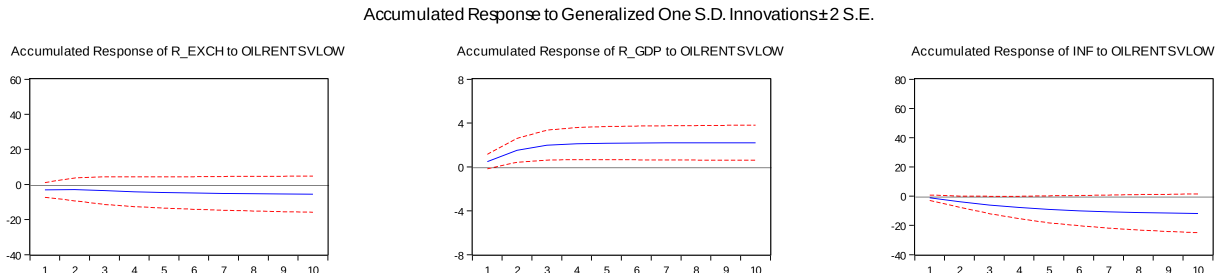
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, HEALTH_EXP= health expenditure

Figure 6.36. Cumulative generalised impulse responses of oil rent low volatility on health expenditure in OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, HEALTH_EXP= health expenditure

6.3.2 Non-OPEC countries analysis

As a further robustness check, this study begins its analysis of the PVAR models separately for oil high and low oil volatility regimes for non-OPEC countries. The findings are presented from Fig. 6.37 to Fig. 6.54 for the oil price volatility (OilV), oil revenue volatility (OilrevenueV) and oil rents volatility (OilrentsV), respectively.

6.3.2.1 Oil price volatility

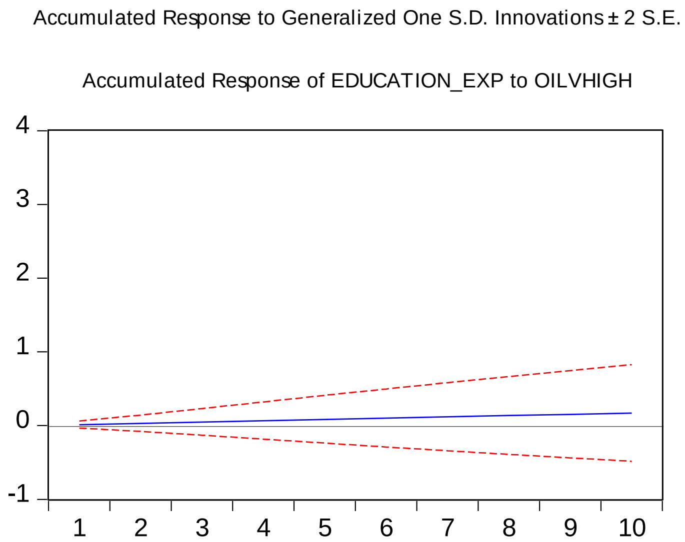
The analysis is continued on the relationship between the direct and indirect effects of oil price volatility regimes and the education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) in non-OPEC countries. The results are shown in Figs. 6.37, 6.38, 6.39, 6.40, 6.41 and 6.42.

6.3.2.1.1 Education expenditure

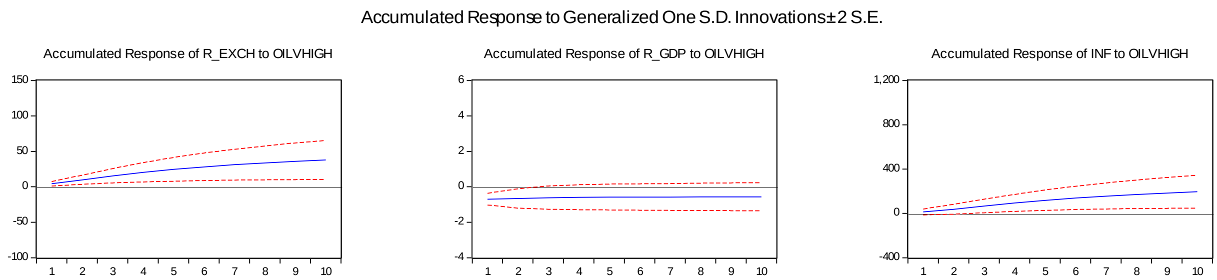
The results for oil price volatility regimes are shown in Figs. 6.37 and 6.38 (see PGIRFs of Appendixes C.37 and C.38). As shown in the panels' oil price high and low volatility regimes on education expenditure in non-OPEC countries in Fig. 6.37 and 6.38, the impact of increasing oil price volatility on the economic variables of the non-OPEC countries is not significant either at the high or low volatility regime. Subsequently, there is no asymmetric impact and its effect is not dependent on the volatility regime.

Figure 6.37. Cumulative generalised impulse responses of oil price high volatility on education expenditure in non-OPEC countries

Direct effects



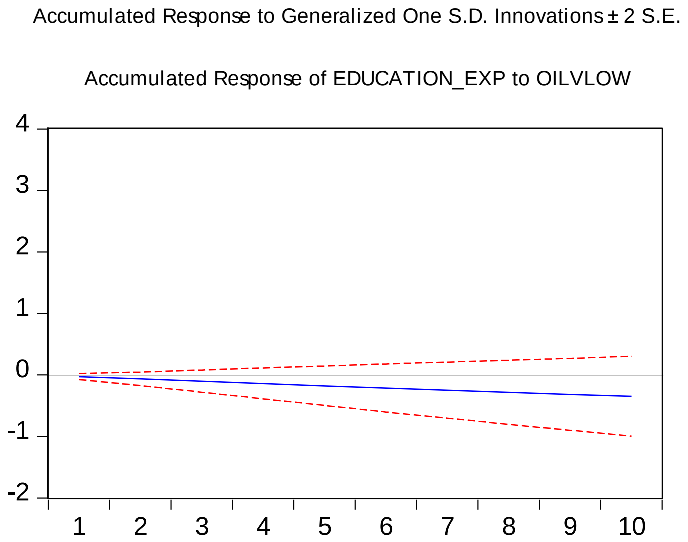
Indirect effects



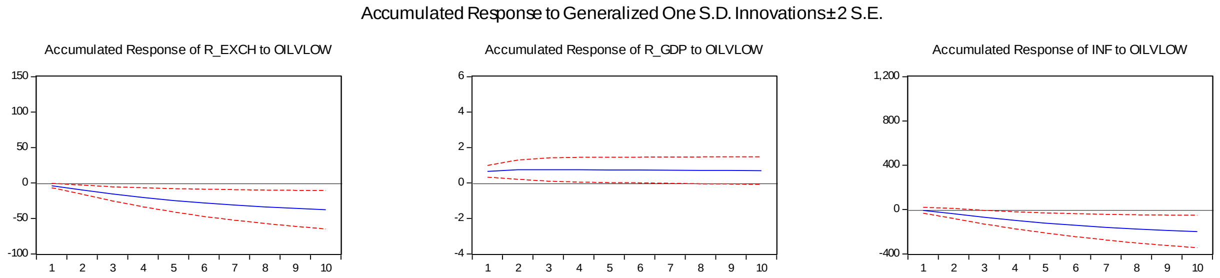
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, EDUCATION_EXP= education expenditure

Figure 6.38. Cumulative generalised impulse responses of oil price low volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



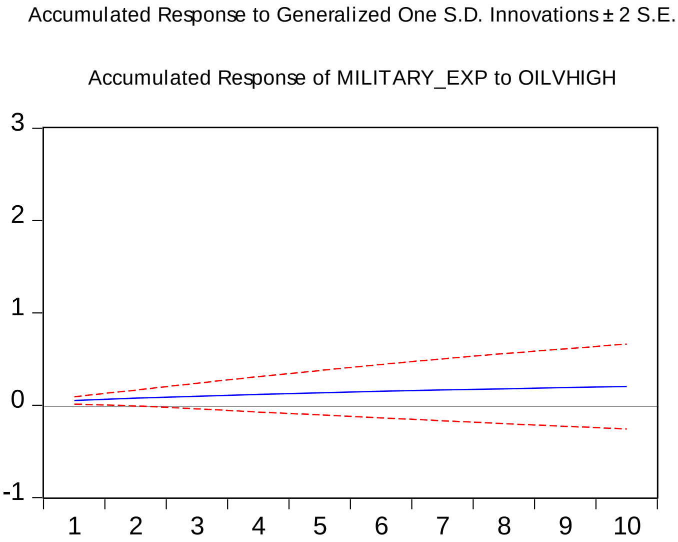
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, EDUCATION_EXP= education expenditure

6.3.2.1.2 __Military expenditure__

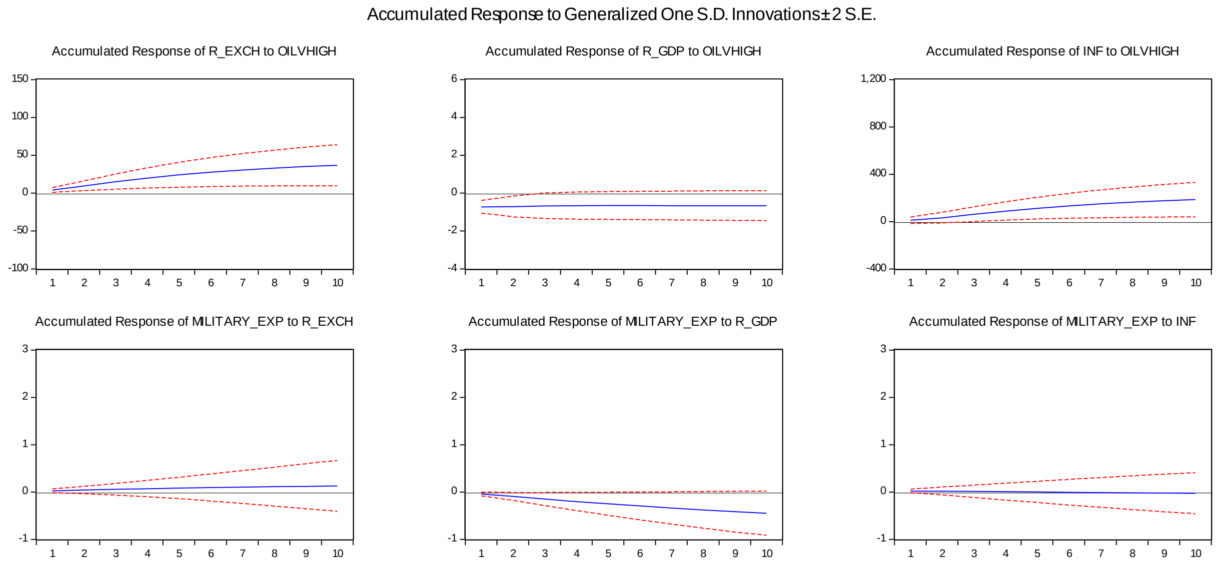
As evident from Figs. 6.39 and 6.40, although oil price volatility in a high volatility regime leads to an increase in the share of military expenditure in non-OPEC countries, the positive shock of an oil price low volatility regime reduces the share of military expenditure (see Appendixes C.39 and C.40). In addition, the response of economic growth to the positive shock of oil price volatility indicates that oil price high volatility will reduce the economic growth of these countries; while the positive shock of oil price low volatility will also increase the economic growth. Possibly, when the oil price volatility occurs in the low regime, economic agents in these countries expect positive effects of oil market changes in the economy of these countries. Therefore, economic growth will be improved if oil price volatility is increased within this regime. Accordingly, such optimism leads to reduction an in expenditure through the direct budget channel by changing the other budget elements, while the reducing economic growth through the indirect channel leads to a reduction in the share of military expenditure. The opposite mechanism also occurs within the high volatility, which leads to an increase in military expenditure. The possible economic reasons for this case were discussed earlier.

Figure 6.39. Cumulative generalised impulse responses of oil price high volatility on military expenditure in non-OPEC countries

Direct effects



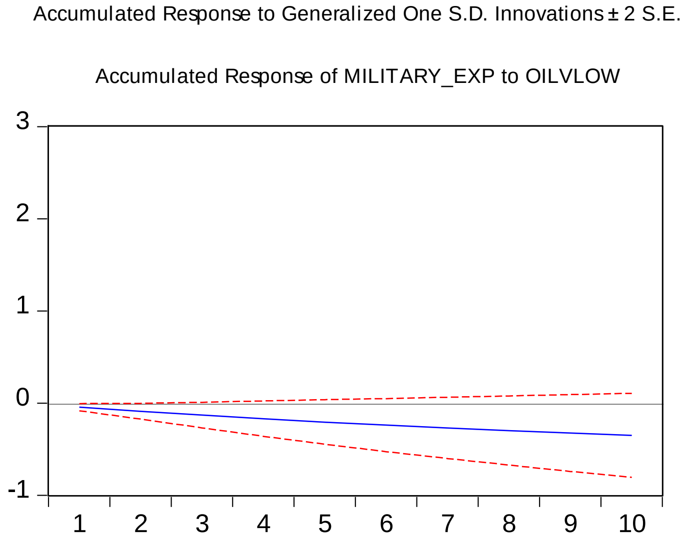
Indirect effects



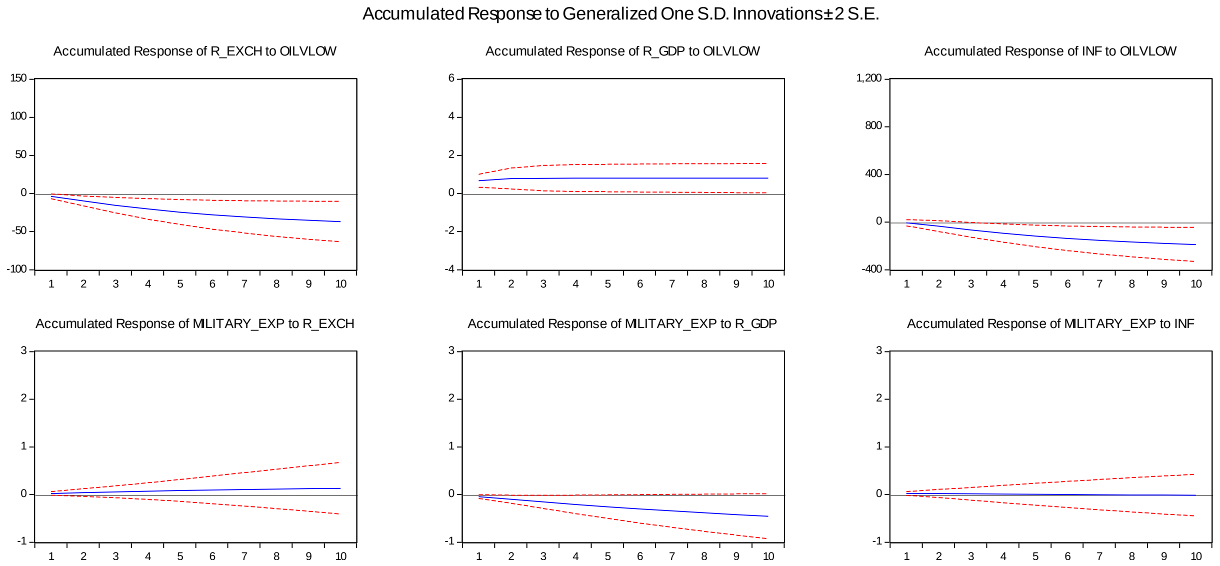
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, MILITARY_EXP= military expenditure

Figure 6.40. Cumulative generalised impulse responses of oil price low volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, MILITARY_EXP= military expenditure

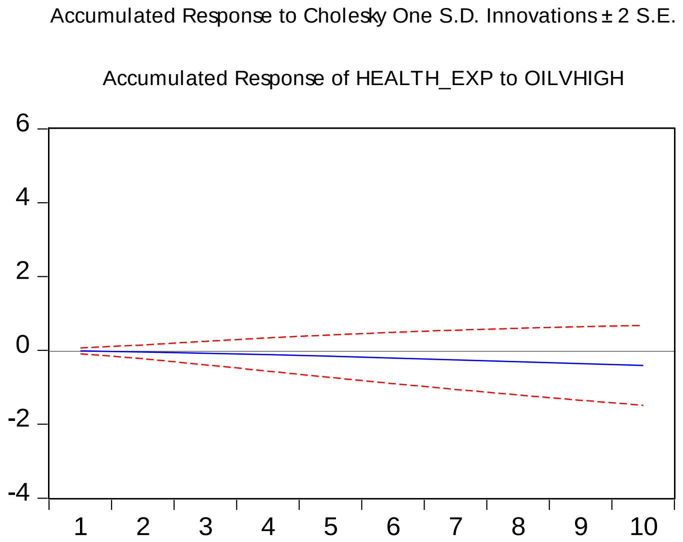
*6.3.2.1.3 **Health expenditure***

In the case of health expenditure in non-OPEC countries, the findings indicate that the relationship between the oil price high volatility regime and health expenditure is similar to the full sample results (see Appendixes C.41 and C.42). However, the existing difference occurs in the low volatility regime of oil price. In this volatility regime, it is seen that an increase in oil price volatility in the economy of these countries improves economic growth and inflation indicators and reduces the exchange rate. Therefore, it seems that oil price volatility in the low regime is not harmful to these countries.

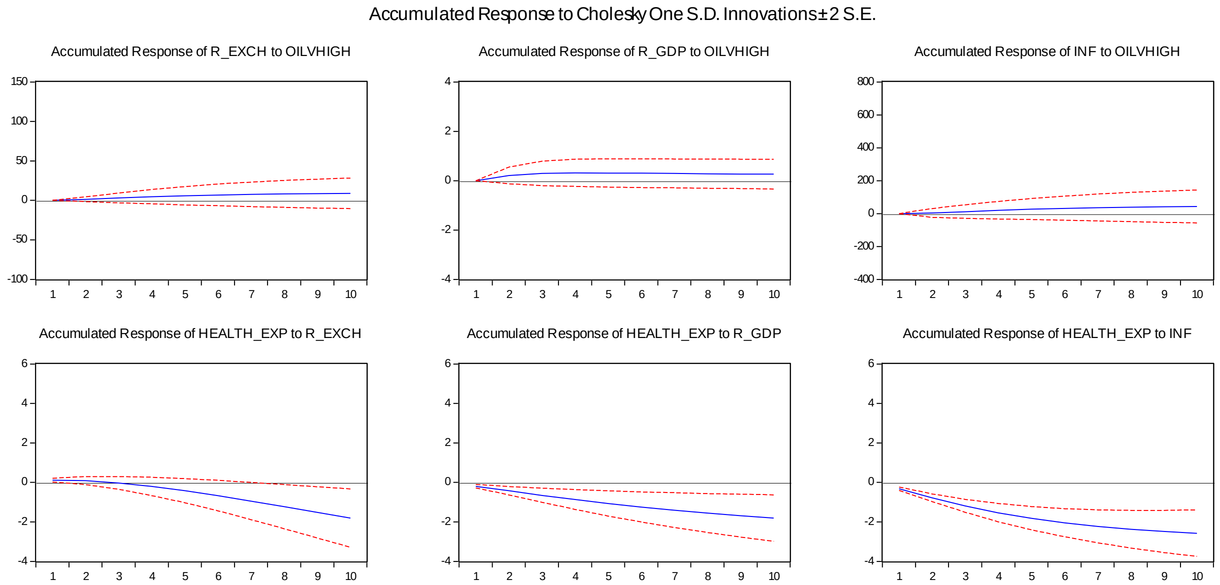
An increase in oil price volatility leads to a reduction in the health expenditure of these countries via the direct channel. The impact of oil price volatility on health expenditure is reduced through the economic growth channel and is increased through both the inflation channel and the exchange rate channel. Reduction in health expenditure through a direct channel may be related to health expenditure stickiness, so it may have been reduced as a percentage of GDP if it occurs along with higher economic growth. The share of health expenditure has been reduced throughout the economic growth channel, and its cause can be related to the relative fixed share of health expenditure. In contrast, the reduction in inflation leads to an increase in health expenditure within the low oil price volatility regime, and the rationale may be related to a greater change in general level prices compared to the price of health expenditure. It can be further observed that the reduction in exchange rate occurs along with increasing the share of health expenditure through the exchange rate channel. The effect of the exchange rate on the denominator of health expenditure, as a percentage of GDP, can be explained as the reason for such an increase in the health expenditure. In this regard, other evidence shows the stickiness of an absolute value of health expenditure. Accordingly, the reduced exchange rate and strengthened national currency can decrease economic growth of these countries by reducing their economic compatibility.

Figure 6.41. Cumulative generalised impulse responses of oil price high volatility on health expenditure in non-OPEC countries

Direct effects



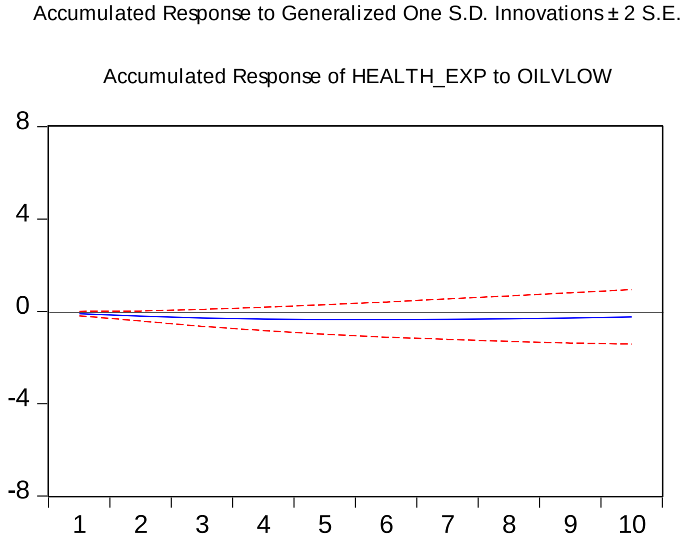
Indirect effects



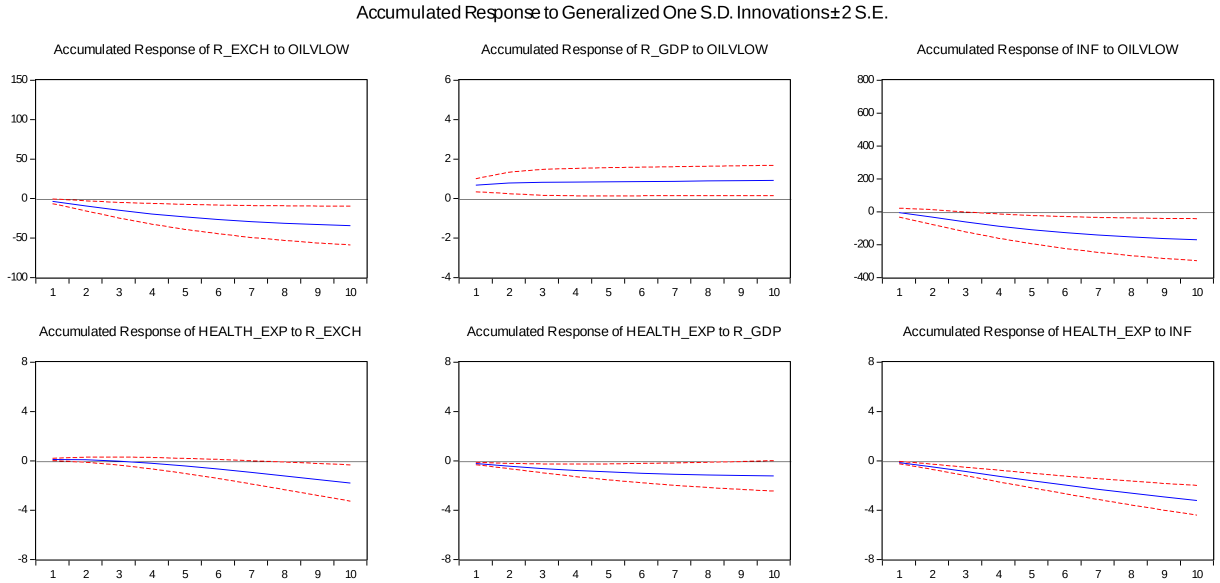
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVHIGH= oil price high volatility, HEALTH_EXP= health expenditure

Figure 6.42. Cumulative generalised impulse responses of oil price low volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILVLOW= oil price low volatility, HEALTH_EXP= health expenditure

6.3.2.2 Oil revenue volatility

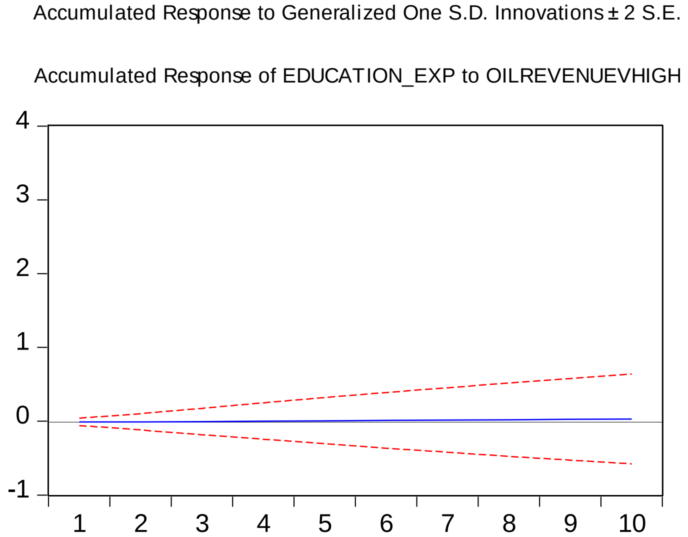
The panel generalised impulse responses functions for the oil revenue volatility regimes on education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) in OPEC countries are reported in Figs. 6.43, 6.44, 6.45, 6.46, 6.47 and 6.48.

6.3.2.2.1 __Education expenditure__

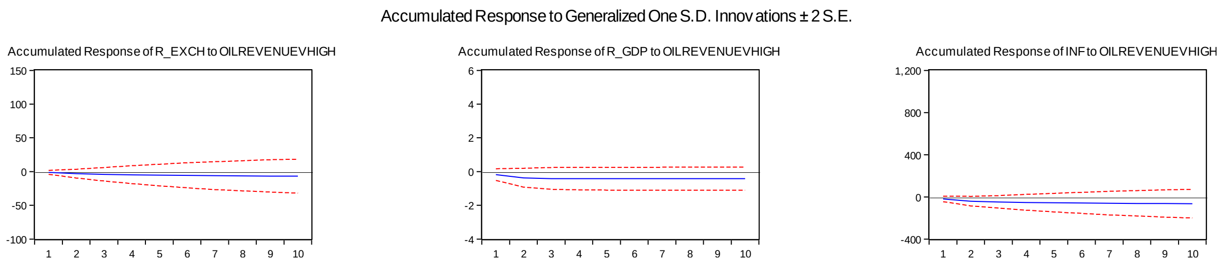
As was shown in the previous chapter, oil revenue high and low volatility do not have any effect on economic indicators in non-OPEC countries; the same result is obtained in this section (see Appendixes C.43 and C.44).

Figure 6.43. Cumulative generalised impulse responses of oil revenue high volatility on education expenditure in non-OPEC countries

Direct effects



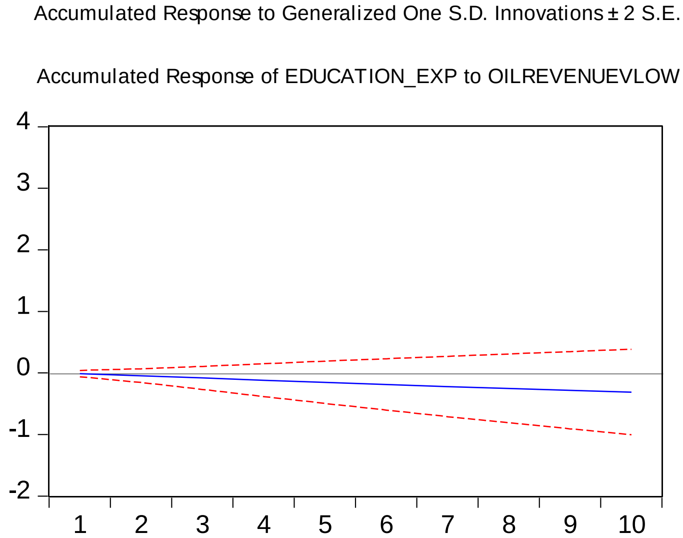
Indirect effects



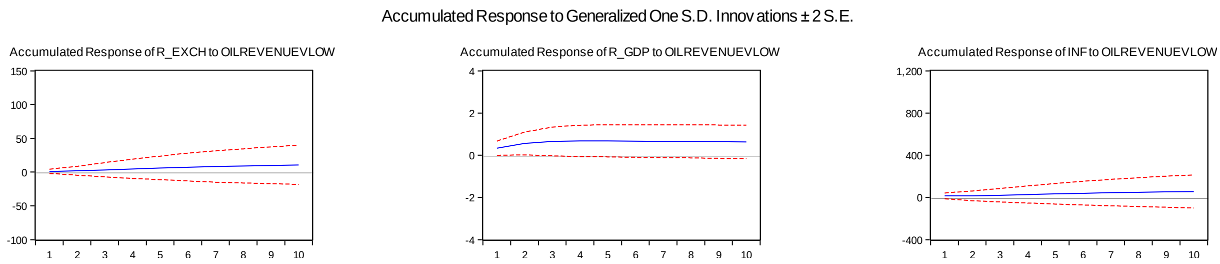
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, EDUCATION_EXP= education expenditure

Figure 6.44. Cumulative generalised impulse responses of oil revenue low volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



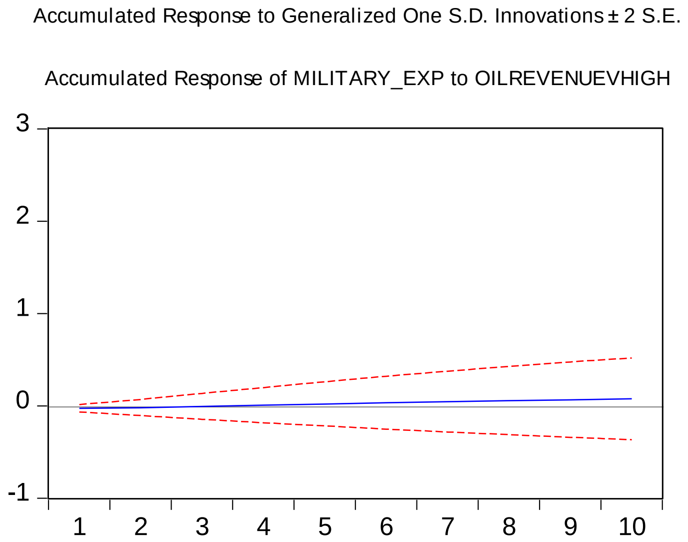
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, EDUCATION_EXP= education expenditure

6.3.2.2.2 <u>Military expenditure</u>

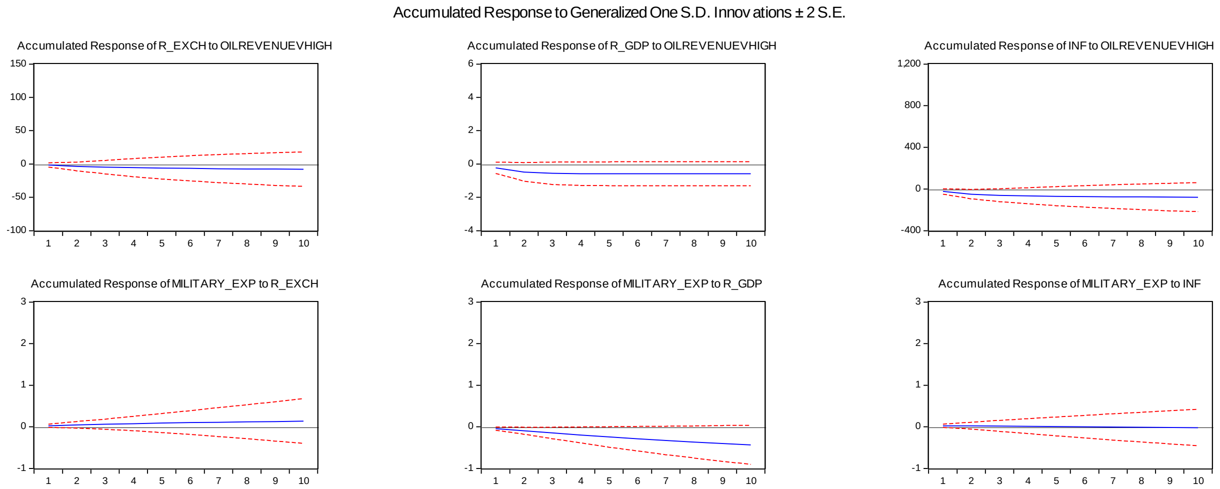
The results of military expenditure imply that the high and low oil revenue volatility does not have any significant effect on military expenditure in non-OPEC countries and the possible causes were discussed earlier (see Appendixes C.45 and C.46).

Figure 6.45. Cumulative generalised impulse responses of oil revenue high volatility on military expenditure in non-OPEC countries

Direct effects



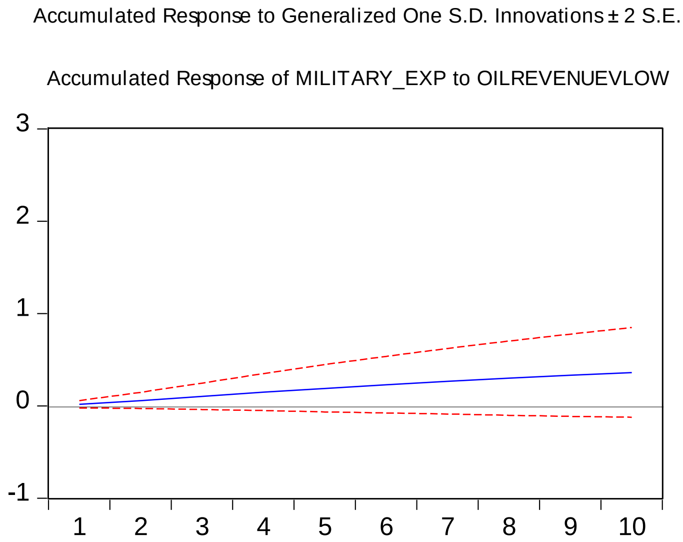
Indirect effects



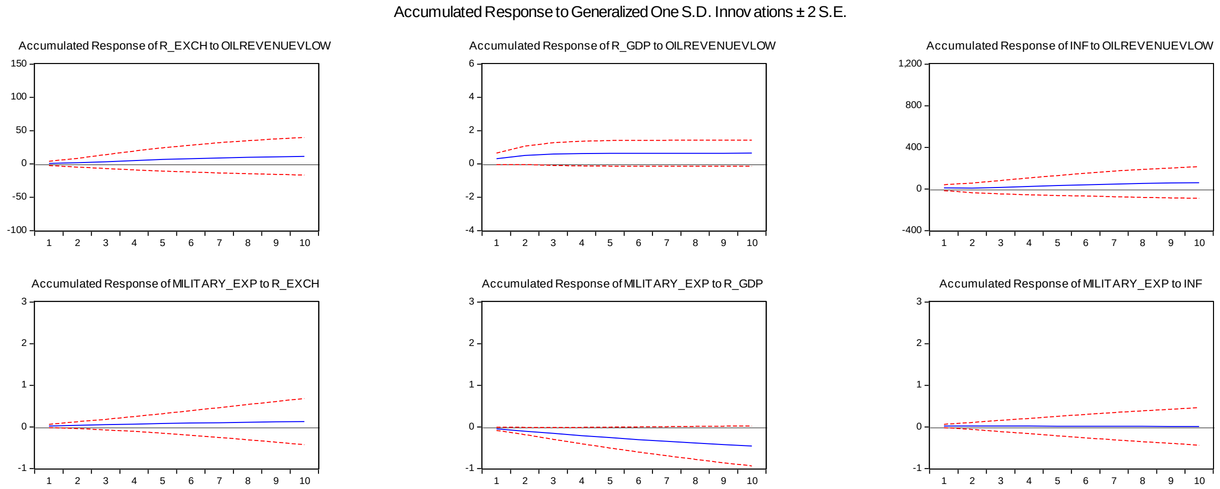
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, MILITARY_EXP= military expenditure

Figure 6.46. Cumulative generalised impulse responses of oil revenue low volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



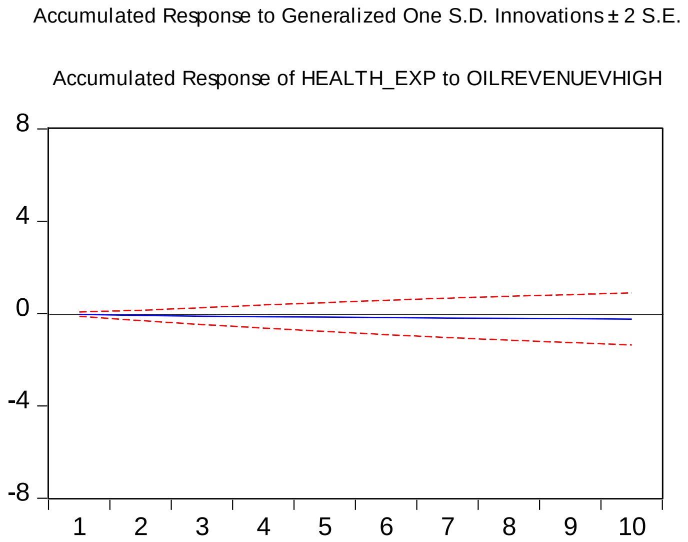
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, MILITARY_EXP= military expenditure

6.3.2.2.3 Health expenditure

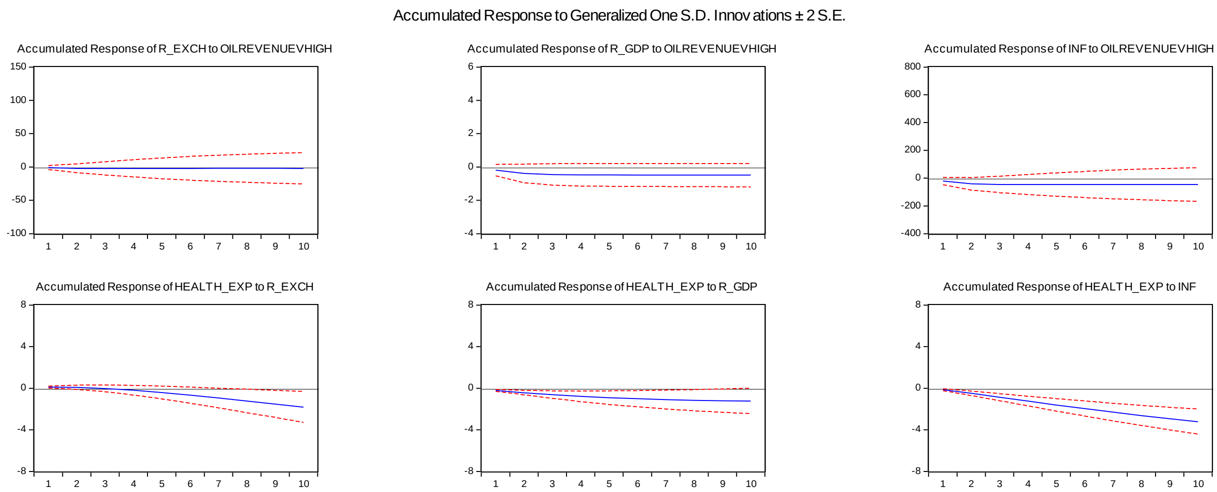
There are similar results obtained for health expenditure, which indicates a lack of effect of oil revenue high and low volatility in non-OPEC countries (see Appendixes C.47 and C.48).

Figure 6.47. Cumulative generalised impulse responses of oil revenue high volatility on health expenditure in non- OPEC countries

Direct effects



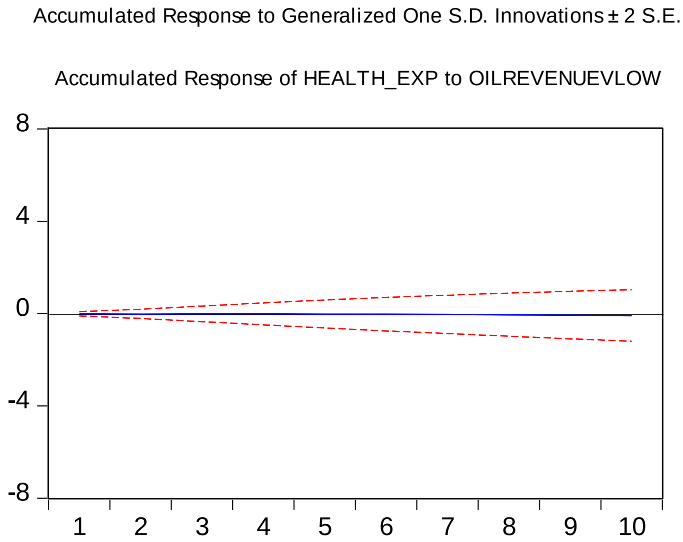
Indirect effects



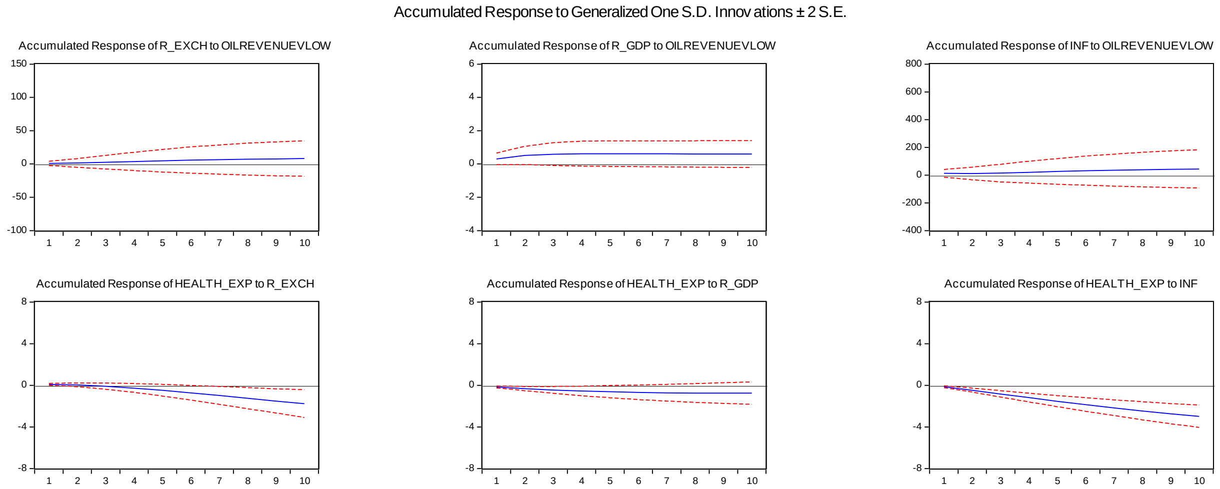
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, Health_EXP= health expenditure

Figure 6.48. Cumulative generalised impulse responses of oil revenue low volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, Health_EXP= health expenditure

6.3.2.3 Oil rent volatility

Subsequently, this study will examine the oil rent volatility regimes and the effect on education (Education_EXP), military (Military_EXP) and health expenditure (Health_EXP) of the non-OPEC countries, as these are reported in Figs. 6.49, 6.50, 6.51, 6.52, 6.53 and 6.54.

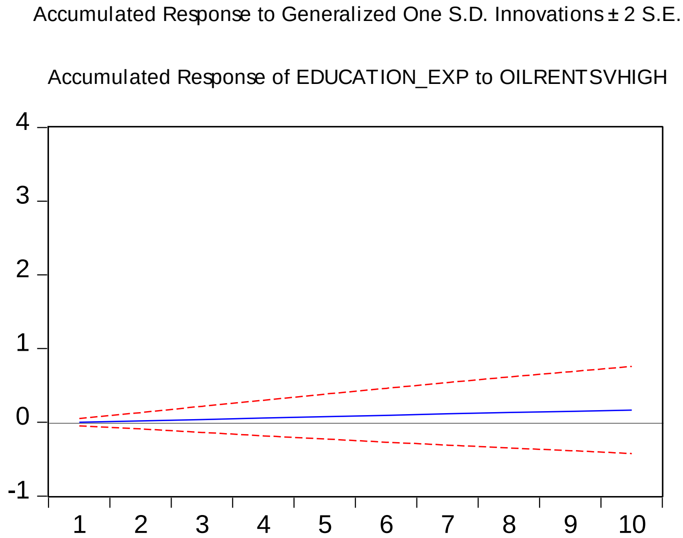
6.3.2.3.1 Education expenditure

If there is oil rent volatility in high and low regimes, there will not be any significant effect of oil rent volatility on education expenditure (see Appendixes C.49 and

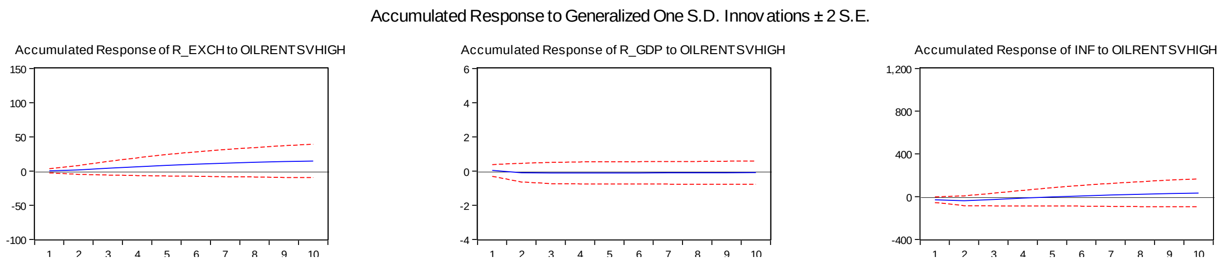
C.50). This is because oil rent volatility does not have a significant effect on economic growth.

Figure 6.49. Cumulative generalised impulse responses of oil rent high volatility on education expenditure in non-OPEC countries

Direct effects



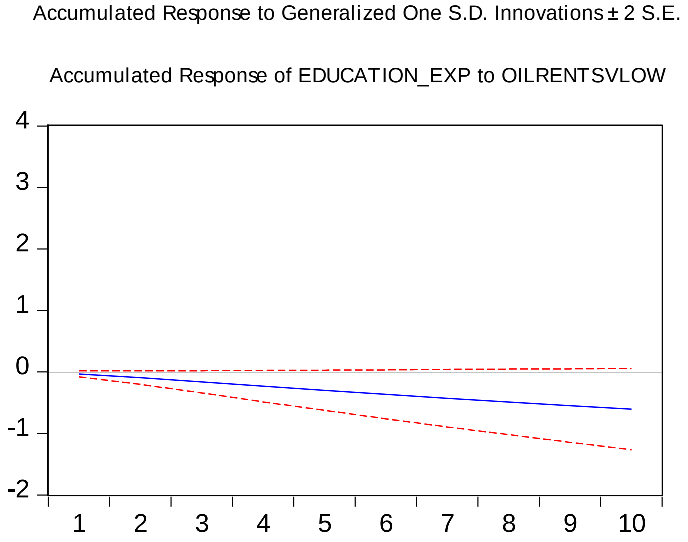
Indirect effects



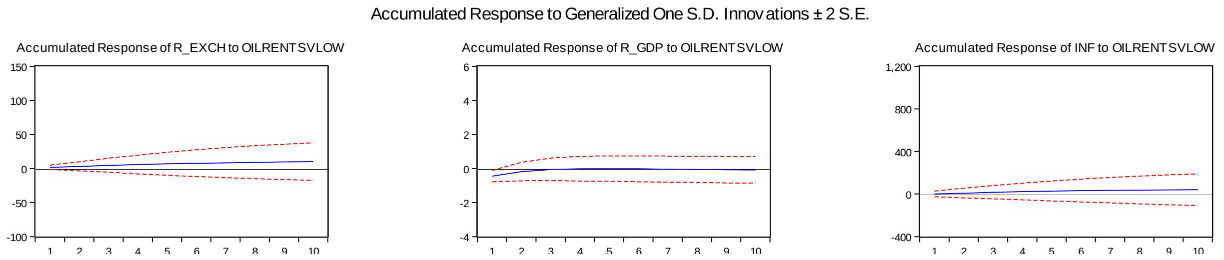
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, EDUCATION_EXP= education expenditure

Figure 6.50. Cumulative generalised impulse responses of oil rent low volatility on education expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, EDUCATION_EXP= education expenditure

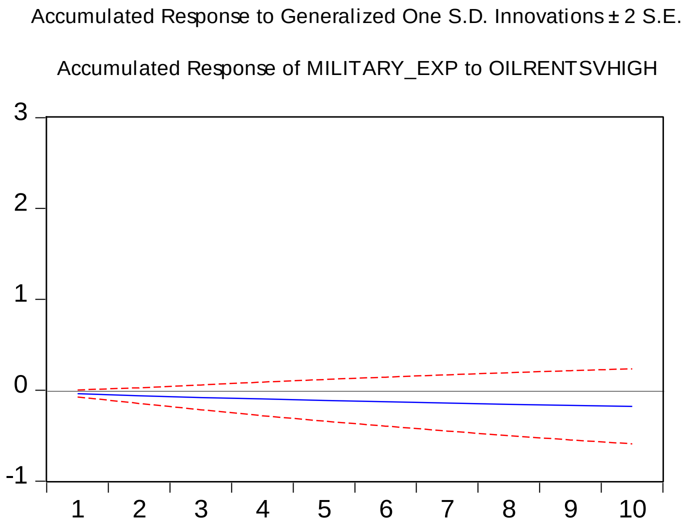
6.3.2.3.2 Military expenditure

The share of military expenditure as a percentage of GDP is reduced in a high oil rent volatility regime, and since economic growth remains unchanged, the absolute value of military expenditure has been reduced (see Appendixes C.51 and C.52). Therefore, the government reduces military expenditure when responding to high oil rent volatility in order to free up the financial resources for other expenditures.

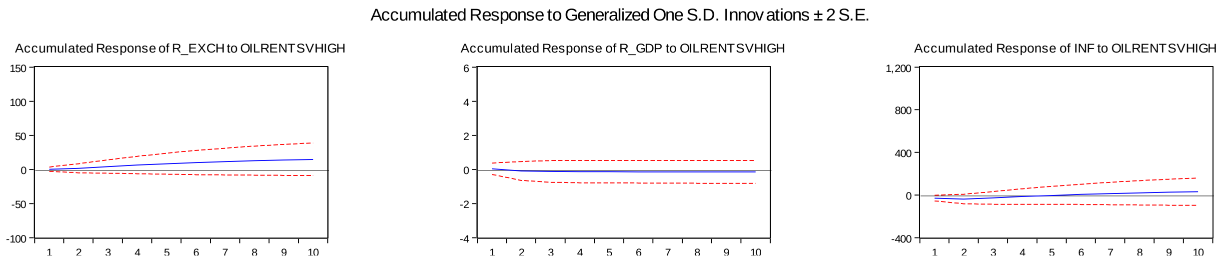
In contrast, there is no direct effect of oil rent volatility on military expenditure within the low volatility regime, while the indirect GDP channels increase the share of military expenditure. As the economic growth rate is decreased, the increase in military expenditure may occur in order for the government to keep the absolute value of military expenditure; however, this effective channel is only in the short term.

Figure 6.51. Cumulative generalised impulse responses of oil rent high volatility on military expenditure in non-OPEC countries

Direct effects



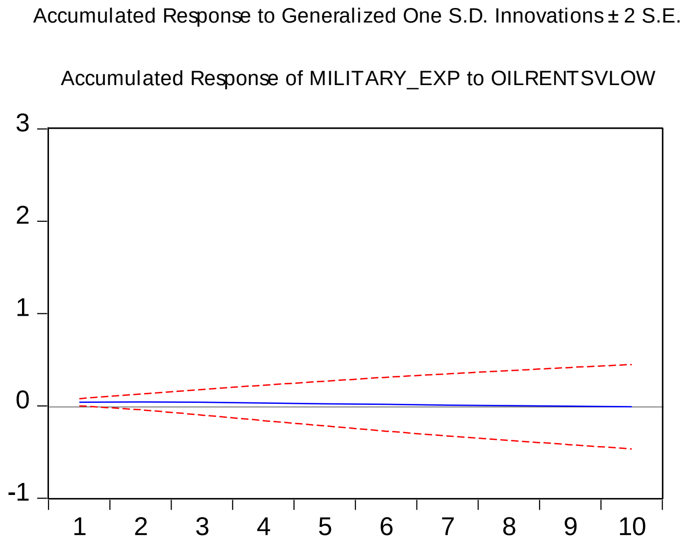
Indirect effects



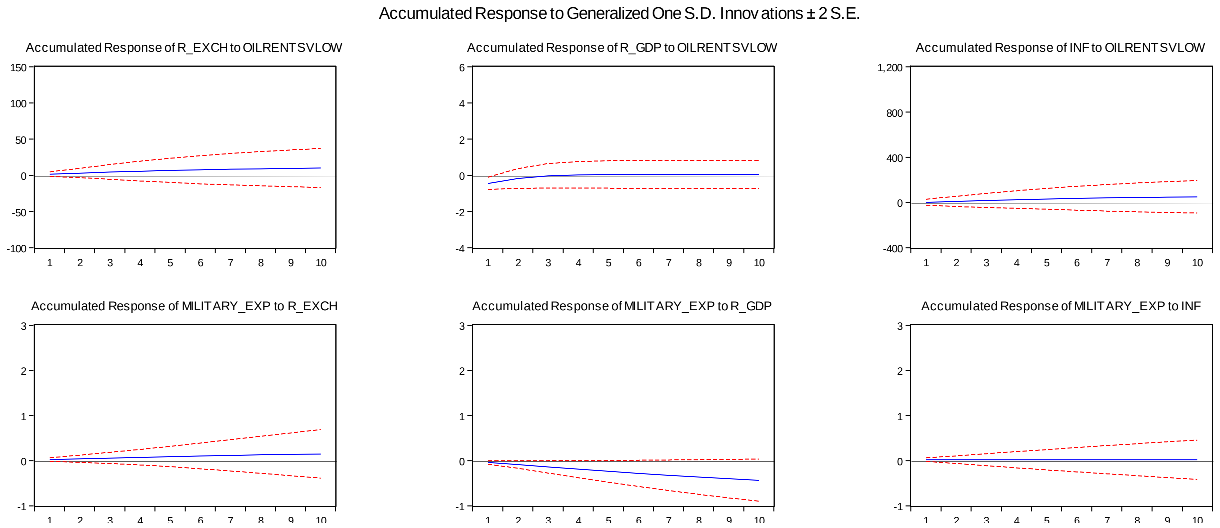
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, MILITARY_EXP= military expenditure

Figure 6.52. Cumulative generalised impulse responses of oil rent low volatility on military expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, MILITARY_EXP= military expenditure

6.3.2.3.3 __Health expenditure__

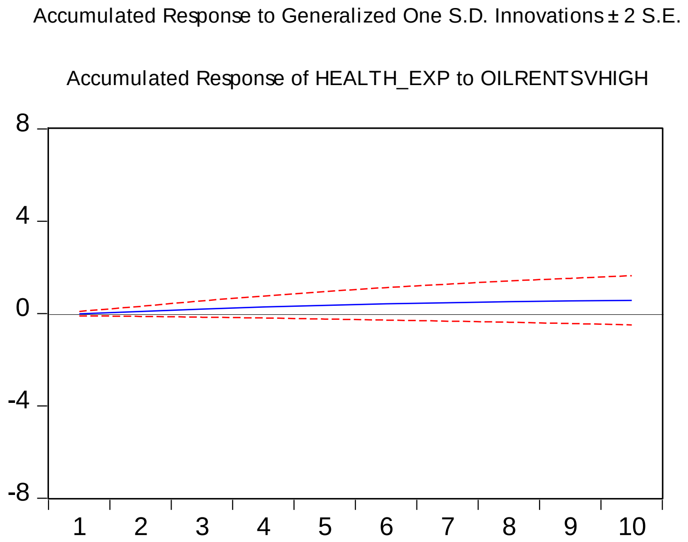
Figs. 6.53 and 6.54 present the estimated findings of the effect of oil rents high and low volatility regimes on the health expenditure in non-OPEC countries (see Appendixes C.53 and C.54).

In the high volatility regime, the share of health expenditure as a percentage of GDP increases through the direct channel. As there is no change in economic growth, there is an increase in the absolute value of health expenditure in the budget. The share of health expenditure increases through the indirect inflation channel. Since the general level of prices are reduced but health expenditure increases, this may be related to the change in relative price, which has increased the absolute value of this variable. However, the share of health expenditure is reduced through the exchange rate channel, and this is due to a greater increase in GDP than that seen in health expenditure, and an increase in the exchange rate leads to a reduction in the share of health expenditure.

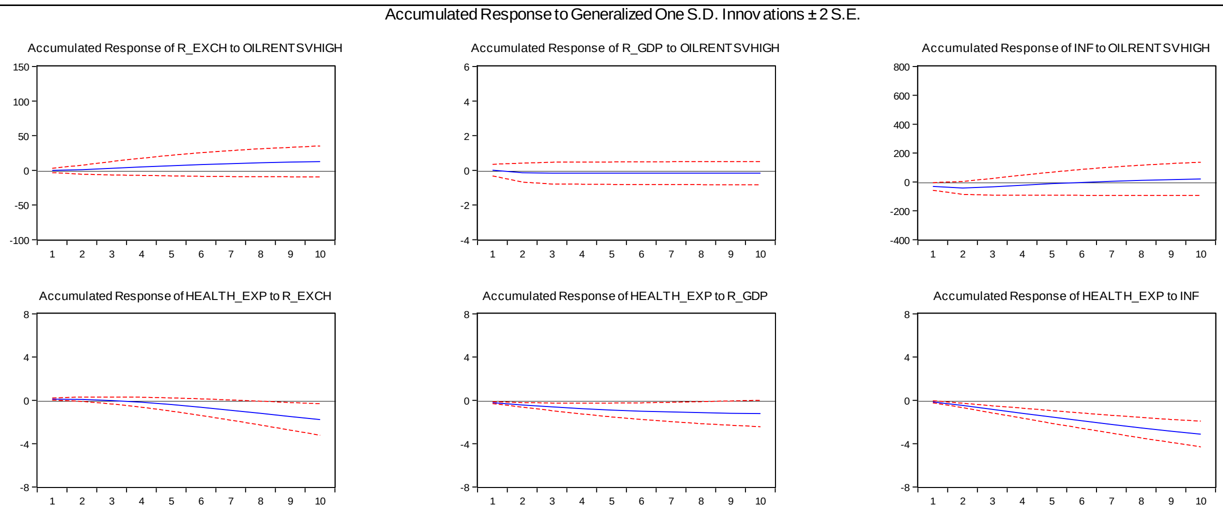
The direct and indirect exchange rate channel exists in the low volatility regime, but the inflation rate channel is not significant. The other difference is related to the active GDP channel. Oil price volatility reduces economic growth through this channel and increases the health expenditure share. As there is no negative relationship between absolute health expenditure and economic growth, an increase in the share of health expenditure is caused by a slower decline than that experienced in relation to economic growth.

Figure 6.53. Cumulative generalised impulse responses of oil rent high volatility on health expenditure in non-OPEC countries

Direct effects



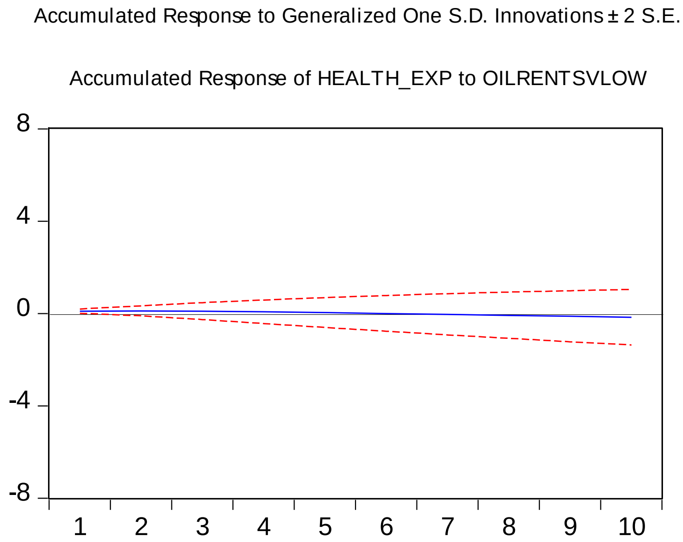
Indirect effects



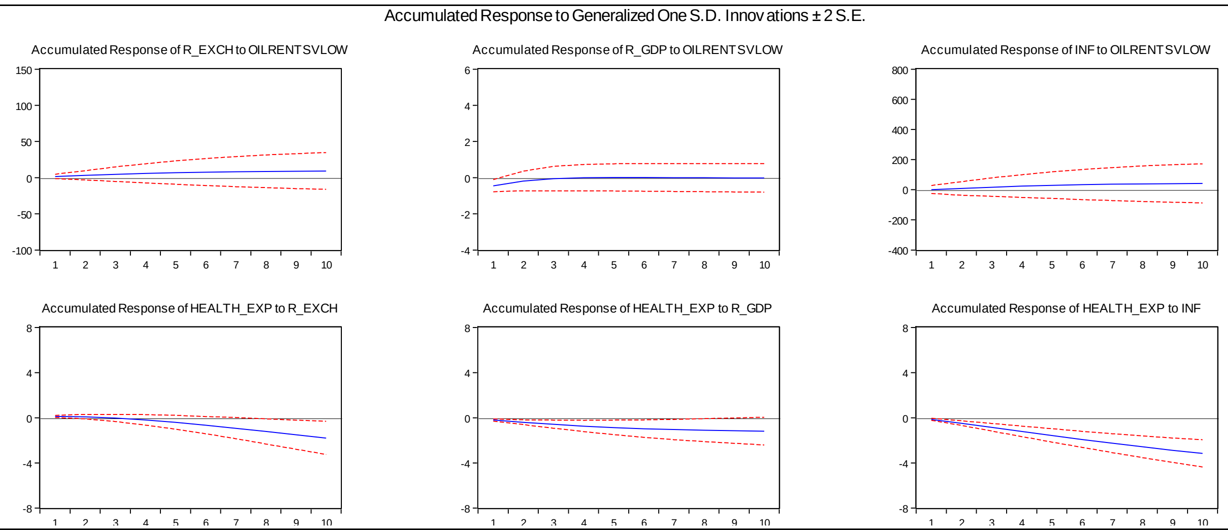
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, HEALTH_EXP= health expenditure

Figure 6.54. Cumulative generalised impulse responses of oil rent low volatility on health expenditure in non-OPEC countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, HEALTH_EXP= health expenditure

6.3.3 Overall Comparison between OPEC/non-OPEC countries

In this section, the study divided the oil volatility regimes and analysed the samples into two sections of high and low volatility to examine the potentially symmetrical effects of oil volatility indications on the countries under investigation. The results obtained from the high and low oil volatility regime have been summarised in table 6.4, 6.5, and 6.6.

There are several asymmetric effects in education expenditure owing to two separate regimes. In OPEC countries, the oil revenue low volatility regime has a positive effect on education expenditure, while there is no significant effect in the high volatility regime. It was suggested earlier that there is probably a positive future prospect of oil revenue increases in the low oil revenue volatility's regime, which positively affects the economy. In non-OPEC countries, the oil rent volatility does not have any effect on education expenditure.

Table 6.4. Oil volatility impact on the education expenditure % GDP in low and high volatility regimes

Volatility proxy	Regime	OPEC	Non-OPEC
Oil price volatility	High volatility regime	No effect	No effect
	Low volatility regime	No effect	No effect
Oil revenue volatility	High volatility regime	No effect	No effect
	Low volatility regime	Positive	No effect
Oil rent volatility	High volatility regime	No effect	No effect
	Low volatility regime	No effect	No effect

In the case of military expenditure, it can be observed that there is an asymmetric effect in both groups of countries. Oil price volatility has a negative impact on the share of military expenditure in OPEC countries, while this effect is positive in non-OPEC countries. It has already been suggested that fewer military weapons are sold to OPEC countries at times of severe oil price volatility, while the increase in expenditure of non-OPEC countries may be related to an increase in their military costs. As was expected for oil revenue volatility, the findings show that there is no impact of the oil revenue volatility regime on military expenditure in OPEC and non-OPEC countries. The uncertainty of oil revenues increases the share of military expenditure and this increase is associated with the described optimism for the future trend of oil revenue in these countries. On the other hand, there is no significant effect in the low volatility regime of oil rent volatility. In a high volatility regime, although the uncertainty of oil rent increases the share of military expenditure in OPEC countries it, however, decrease it in non-OPEC countries. The mechanism of this change seems different. Thus, economic growth is reduced in OPEC countries, but their military expenditure is very sticky, and, therefore, military expenditure will be increased in these countries. In non-OPEC countries, the absolute value of military expenditures will be reduced in order to free up the financial resources for other expenditure.

Table 6.5. Oil volatility impact on the military expenditure % GDP in low and high volatility regimes

Volatility proxy	Regime	OPEC	Non-OPEC
Oil price volatility	High volatility regime	Negative	Positive
	Low volatility regime	No effect	No effect
Oil revenue volatility	High volatility regime	No effect	No effect
	Low volatility regime	Positive	No effect
Oil rent volatility	High volatility regime	Positive	Negative
	Low volatility regime	No effect	No effect

There are asymmetric effects of oil volatility indicators on health expenditure in the two groups of studied countries. In terms of oil price volatility, the share of health expenditure increases at the high volatility regime in OPEC countries; as the oil price volatility does not have any effect on the economic indicators of these countries, it seems that the increase in health expenditure is related to their non-economic developments. In non-OPEC countries, the oil price volatility at the low volatility regime has a negative impact on the share of health expenditure, and these possible reasons have already been discussed. In terms of oil revenue volatility, the share of health expenditure increases in OPEC countries, and a possible reason is the severe reduction in economic growth and a lower change in the absolute value of health expenditure. In non-OPEC countries, oil revenue volatility does not exert any significant effect. There was no change in OPEC countries in terms of oil rent volatility, while the oil rent high and low volatility regimes increase the share of health expenditure in non-OPEC countries.

Table 6.6. Oil volatility impact on the health expenditure % GDP in low and high volatility regimes

Volatility proxy	Regime	OPEC	Non-OPEC
Oil price volatility	High volatility regime	Positive	No effect
	Low volatility regime	No effect	Negative
Oil revenue volatility	High volatility regime	Positive	No effect
	Low volatility regime	No effect	No effect
Oil rent volatility	High volatility regime	No effect	Positive
	Low volatility regime	No effect	Positive

6.4 Conclusion

This chapter has examined the direct and indirect effect of oil volatility on disaggregated government expenditure, which consists of education, military, and health expenditure in OPEC and non-OPEC countries. The sample period runs between 1983 and 2015 and a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions are employed.

The results of this empirical analysis can be summarised as follows: firstly, similar to the results of the previous chapter, oil price volatility does not exert any significant direct or indirect effect on the economic indicators of OPEC countries, whereas in non-OPEC countries, oil revenue volatility does not exert any effect on disaggregated government expenditure. Secondly, governments reduce education expenditure when responding to oil uncertainty in both OPEC and non-OPEC countries. Thirdly, not only is military expenditure sticky in both of the studied countries, but also this variable, in some cases, increases in response to oil volatility. Fourthly, health expenditure, like military expenditure, shows a tendency to stickiness with low elasticity in both types of countries, so the share of health expenditure is increased in some cases due to the negative effects of oil volatility on the economic growth.

Therefore, it can be concluded that oil volatility in the studied countries force their governments reduce education expenditure in order to finance their other costs. In this case, some vital health costs will prevent them from reducing these costs. In contrast, the military expenditure of both types of countries is increased due to reasons already discussed.

Chapter 7- The Dynamic Impact among Oil Volatility, the Quality of Political Institutions, and Government Spending

7.1 Introduction

In this chapter, this study investigates the direct and indirect effect of the role of democracy, and, in turn, the effect of oil volatility on governmental expenditure in oil exporting countries. To achieve that, it applies a panel Vector Auto-Regressive (PVAR) approach along with panel impulse response functions from the period 1983 to 2015.

Democracy is an index of political distribution institutes. Countries with great democracies are more efficient in their distribution process, so that the political power is distributed among a wide range of different parts of society in these countries (Acemoglu et al. 2005).

Oil revenues enter into the economic system of oil exporting countries through their economic mechanisms, and institutional factors play a vital role in distributing oil revenues in the economy. Therefore, many studies, such as Mehlum et al. (2006) and Boschini et al. (2007), indicate that the quality of economic institutions have a substantial role in converting natural resources to a resource curse. Some studies show that the weaknesses inherent in non-democratic institutions intensify the resource curse. Apergis and Payne (2014) conduct a study of Middle Eastern and North African countries, and conclude that by improving institutional quality, the destructive effects of the resource curse are neutralized. El-Anshasy et al. (2017) examine a study of 17 important oil countries and find that better institutions (financial policy) can neutralise the negative effects of oil revenue volatility. They find that oil revenue volatility, along with inappropriate political and economic responses of government to these volatilities, leads to the resource curse. They recommend the establishment of futuristic institutions, such as a national reserve and stabilization funds, to solve this problem. Damania and Bulte (2008) prove that a lack of political competition increases the accessibility of governors to resources, causing them to spend non-optimally. Bhattacharyya and Hodler (2010) explain that democratisation is a solution that can reduce corruption in countries with abundant resources. However, some studies consider democracy as a tool to gain rent, and this is the reason for resource loss. Bjorvatn and Selvik (2008) explain that a Sectarian democracy has led to a political competition to take advantage of oil rents in Iran, so that the election winner of 2005 was the person who had promised direct payments to people.

If the institutional structure of an oil exporting country has a clear framework, and efficient system regarding its economic development, then there will be a difference in the distribution and spending of oil export revenues when compared with weak, rent oriented, and corrupt institutions. In an optimal institutional framework with an economic development goal, oil revenues will be directed towards productive economic activities in order to maximize social interests. On the contrary, an institutional framework that does not look to maximize social interests and is only of benefit to a specific group in society, will be detrimental to that goal. Therefore, there is an expectation that there will be a difference in government expenditure that is responding to changing oil revenues within different institutional frameworks. If oil resources are owned by the government, the government structure is a factor that is affecting the allocation and spending of oil wealth, as well as the resources of rent distribution.

It is important to know how to allocate oil wealth and organise the tax system in countries with abundant natural resources, together with the institutional framework and quality. This will determine how the tax system will adapt to the domestic production of the country. In an institutional framework, in which the government is not responsible to the people and where they do not need to collect taxes (because such a government is the owner of oil revenues), the government expenditures will be planned in a different way, compared to the case where the existing institutional framework is based on a responsible government. This is as well as an efficient and clear tax system, in which taxes are spent, transparently, to maximize the social interests of the whole society. Therefore, the institutional structure of the government is an effective factor in financing government spending. De Schweinitz (1964) and McGuir and Olson (1996) explain that democracy embraces a higher tax regime. Tonizzo (2008) finds that countries with a stronger democracy have smaller governments. Moshiri (2015) examines a study on 9 oil exporting countries, including developing and developed ones, and suggests that the reason countries show heterogeneous responses to oil shocks is due to their different institutional qualities and government efficiency. Stasavage (2005) illustrates a positive relationship between democracy and the government's educational spending in African countries. Balamatsias (2018) analyses 61 countries and show a rise in government spending on public products and education in democracies.

In this way, this study examines the effects of oil volatility on government spending, as a percentage of GDP, and does this in this chapter by separating the countries into two groups, one democratic and the other non-democratic; then the study is developed by separating the various government expenditure components into education, military and health expenditures.

As is mentioned, the difference in the quality of institutions is important and determines their reaction to oil shocks and reflects on the way that oil countries decide on the allocation of oil revenues in the form of oil rents. Since the economic consequences of oil volatility in these countries depend on government decisions, therefore the quality of economic institutions is important in this decision-making process. There are evidence that democratic and non-democratic governments both behave and react differently to factors relating to oil volatility and therefore, the quality of political institutions in their response to expenditure (size and composition of these expenditures) brings a significant degree of uncertainty. The response not only changes the share of government expenditure but also changes composition. Therefore, it is important to understand, within the context of the political economy, the differing reactions to oil price volatility and to explore any differences between different forms of government. There is little in literature that researches this important element within the global oil market, and it is a gap in oil literature empirical research. The evidence provided will be an important contribution to knowledge and provide policy guidelines as to how governments can react positively to oil price shocks.

The results reported in this chapter are accompanied by a limited amount of explanation. This is because they are to a degree related to those seen in previous ones and therefore certain descriptions and explanatory comment are omitted for the sake of brevity and to avoid repetition. Nevertheless, for completeness all results are reported in full regardless of significance.

7.2 Democratic countries and government spending

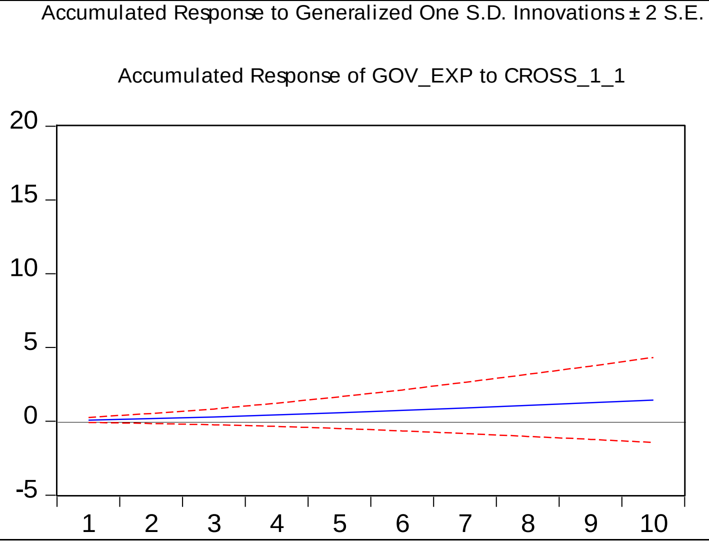
This section examines the response of government spending to oil volatility in oil-exporting countries that are categorized as democratic based on the definition given in Chapter 4. In the next section, this issue will be addressed in the category of non-democratic countries, and the results compared.

7.2.1 Cross_1_1 (OilV_aut0dem1)

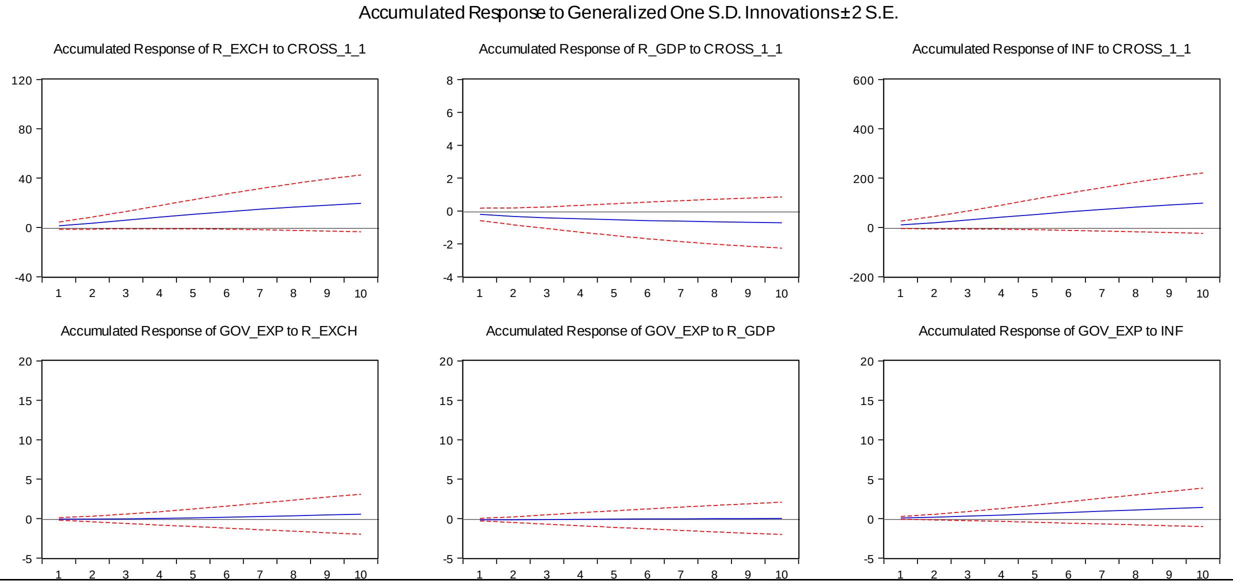
The results in Fig. 7.1, indicate that a positive shock to oil price volatility corresponds to a positive response in government spending, as a percentage of GDP, in democratic countries (see PGIRFs of Appendix D.1). In addition, the indirect effect of oil price volatility occurs through the inflation channel, which is due to an increase in oil price uncertainty after inflation expectations are formed in these countries. The economic rationale for the results observed were discussed in a previous chapter (e.g. section 5.2.2) and covered rising uncertainty which resulted in the expectation of increasing inflation, falling GDP and the potential effect on government expenditure Therefore, oil price volatility can affect government expenditure, as a percentage of GDP, in democratic countries, these results being similar to those obtained for non-OPEC countries.

Figure 7.1. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on government spending in Democratic countries

Direct effects



Indirect effects



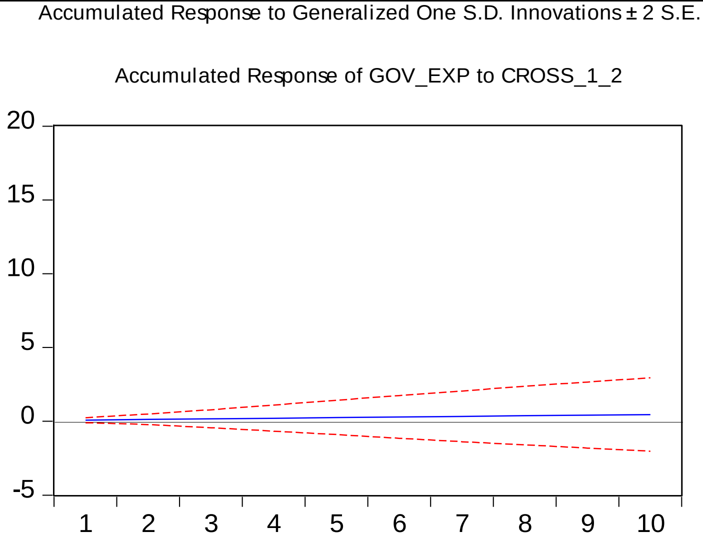
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, GOV_EXP= government spending

7.2.2 Cross_1_2 (OilrevenueV_aut0dem1)

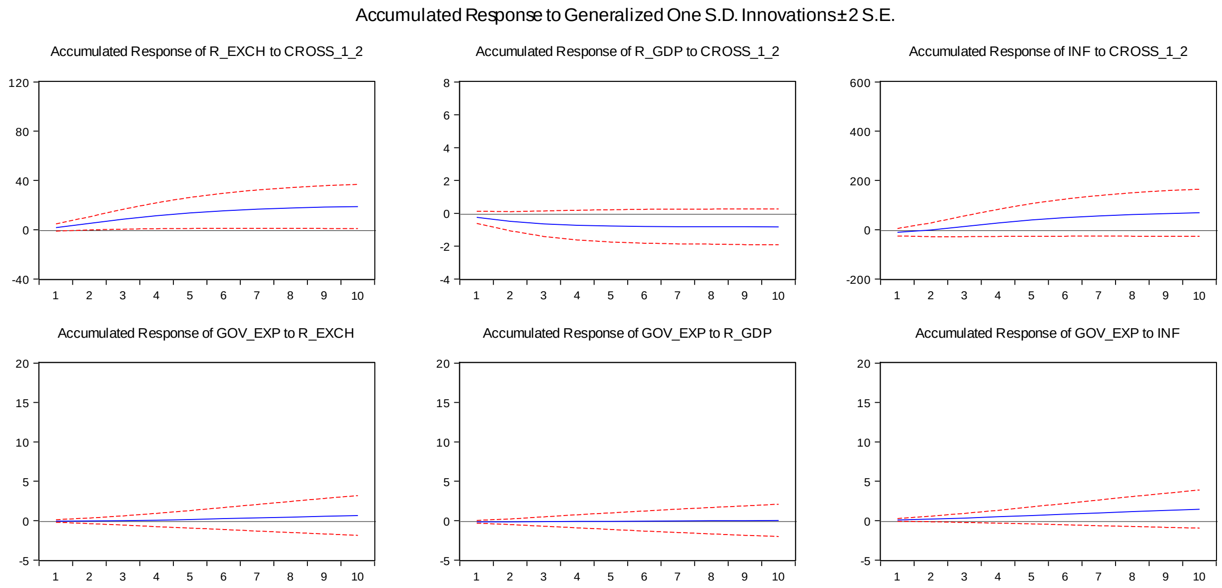
The direct and indirect effect of oil revenue volatility shocks on government expenditure in democratic countries is reported in Fig. 7.2 (see PGIRFs of Appendix D.2). The findings suggest that Cross_1_2 (OilrevenueV_aut0dem1) does not exert any significant direct effect on GOV_EXP, as a percentage of GDP, whereas there is an indirect channel by which Cross_1_2 (OilrevenueV_aut0dem1) impacts GOV_EXP. These effects are propagated via the effects of Cross_1_2 (OilrevenueV_aut0dem1) on inflation. The results show that the Cross_1_2 (OilrevenueV_aut0dem1) on INF is positive in democratic groups, and the subsequent increase in inflation will lead to an increased share of government expenditure, as a percentage of GDP.

Figure 7.2. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on government spending in Democratic countries

Direct effects



Indirect effects



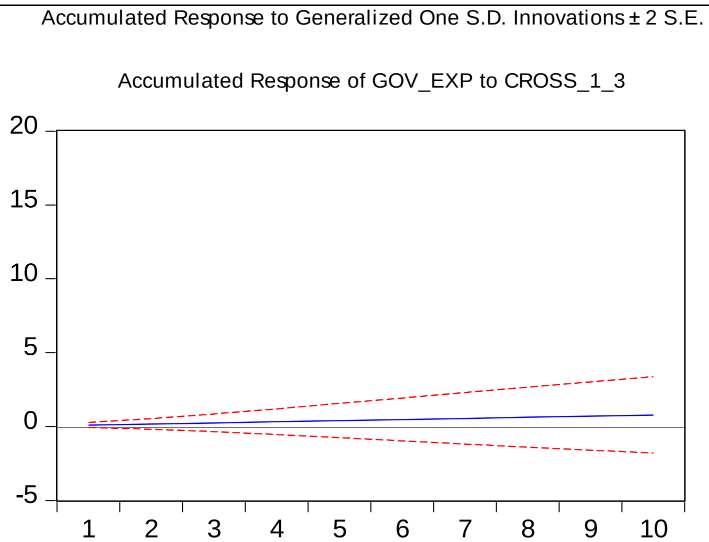
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= (OilrevenueV_aut0dem1), GOV_EXP= government spending

7.2.3 Cross_1_3 (OilrentsV_aut0dem1)

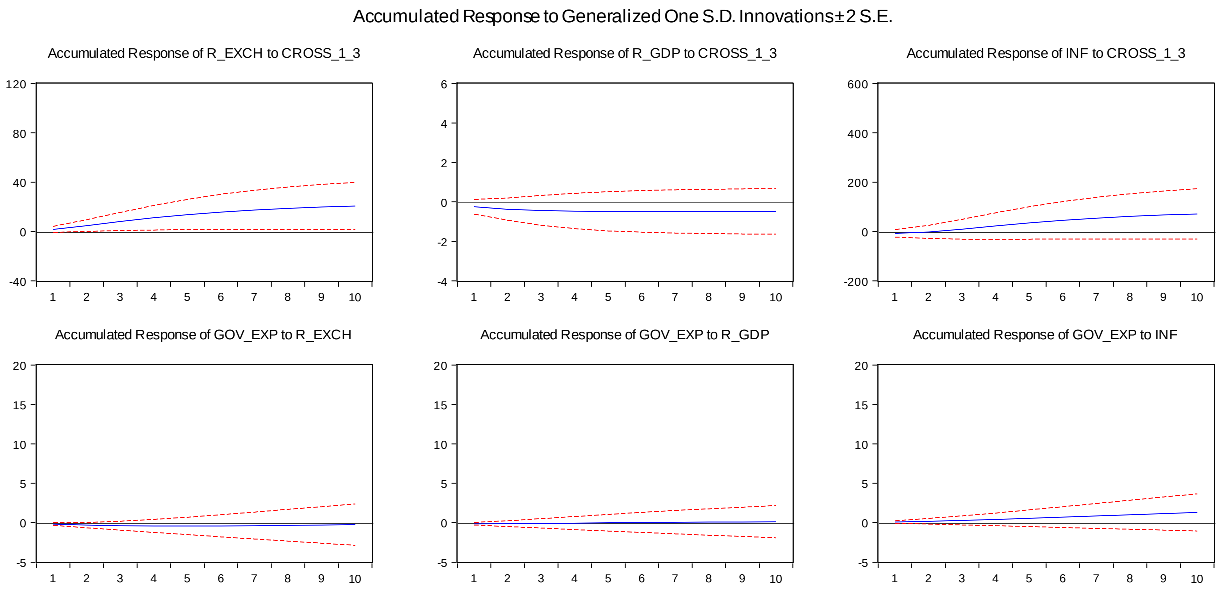
According to Fig. 7.3, the results show that a rise in oil rent volatility does not lead to any significant direct response in GOV_EXP, as a percentage of GDP, while it can be observed that there are indirect effects of an oil rent volatility shock to GOV_EXP, via the exchange rate channel (see PGIRFs of Appendix D.3). Thus, the government expenditure, as a percentage of GDP, is reduced through the indirect channel of the exchange rate. As there is a reduction in economic growth; therefore, an increase in oil rent volatility leads to a decline in the absolute value of government expenditure.

Figure 7.3. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on government spending in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= (OilrentV_aut0dem1), GOV_EXP= government spending

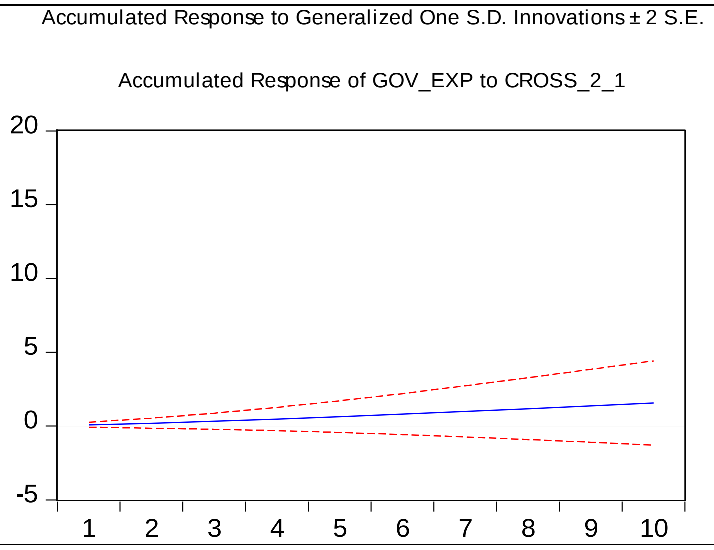
7.2.4 Cross_2_1 (OilV_aut0dem1xrreg)

In this section, another indicator of institutional quality will be used in the model, which is the degree of constraints to the executive. In other words, it measures the emergence of democratic attributes. Thus, among democratic countries, we can also see the difference in the results of the previous section by changing the quality of democracy.

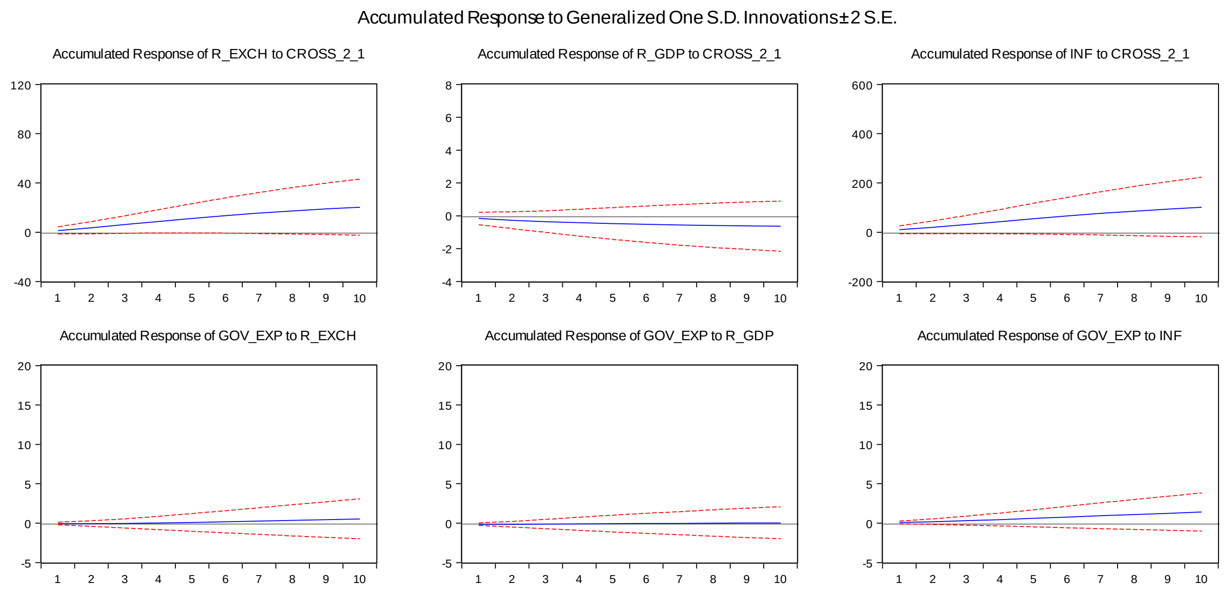
Multiplicative variable of xrreg is used to evaluate the degree of constraints on the executive in the effect of oil volatility on the share of government expenditure (see PGIRFs of Appendix D.4). Figure 7.4 depicts that a standard deviation shock to oil price volatility, when there is a significant constraint on the executive in democratic countries, leads to an increase in the share of government expenditure through the direct channel. A similar result occurs through the indirect inflation channel.

Figure 7.4. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on government spending in Democratic countries

Direct effects



Indirect effects



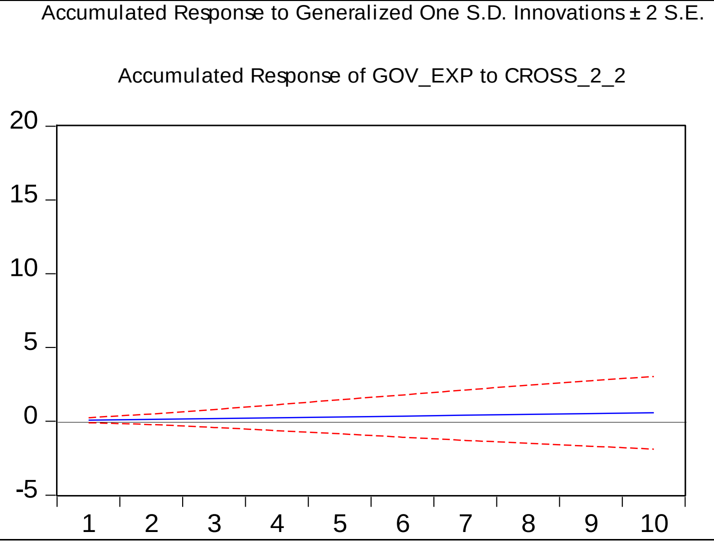
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut0dem1xrreg), GOV_EXP= government spending

7.2.5 Cross_2_2 (OilrevenueV_aut0dem1xrreg)

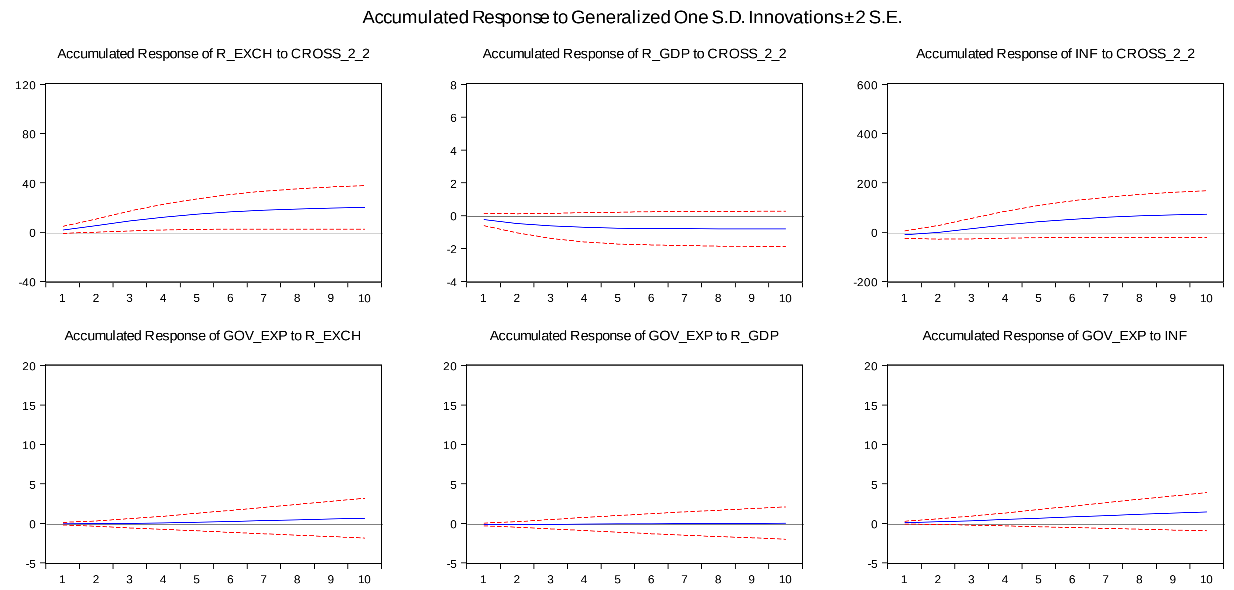
According to the results in Fig. 7.5, it is observed that a standard deviation of oil revenue volatility shock does not exert any significant direct effect on GOV_EXP, when considering constraints on the executive in democratic countries, but there will be an increase in government expenditure through the indirect channel of inflation, again the same as the previous result without considering the xrreg variable (see PGIRFs of Appendix D.5).

Figure 7.5. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on government spending in Democratic countries

Direct effects



Indirect effects



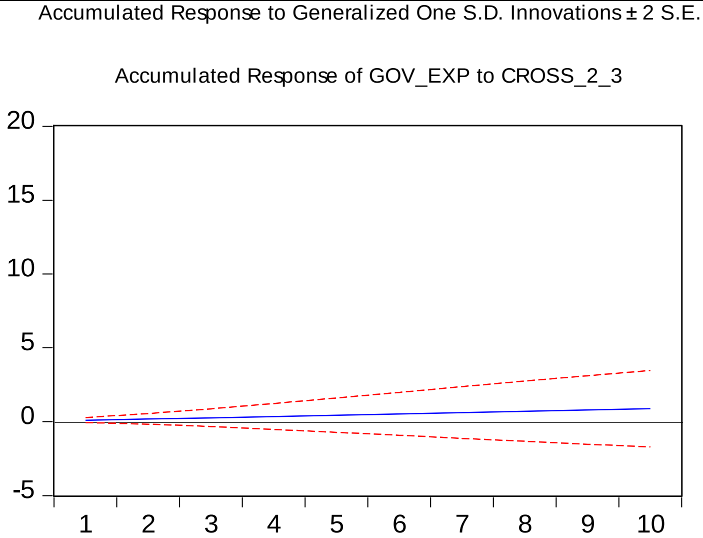
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut0dem1xrreg), GOV_EXP= government spending

7.2.6 Cross_2_3 (OilrentsV_aut0dem1xrreg)

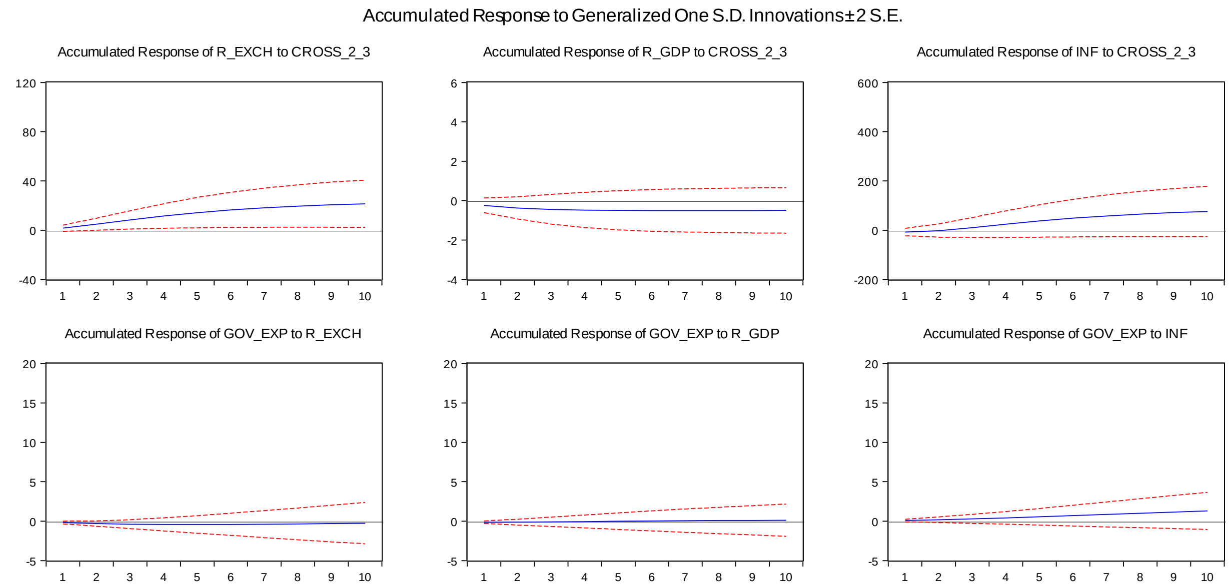
In Fig. 7.6, the result shows that a standard deviation shock to oil rent volatility does not lead to any significant direct effect on government GOV_EXP, when considering constraints on the executive in democratic countries, while there will be an increase in government expenditure through the indirect channel of the exchange rate, again the same as the previous result without considering the xrreg variable (see PGIRFs of Appendix D.6).

Figure 7.6. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on government spending in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut0dem1xrreg, GOV_EXP= government spending

7.3 Non-Democratic countries and government spending

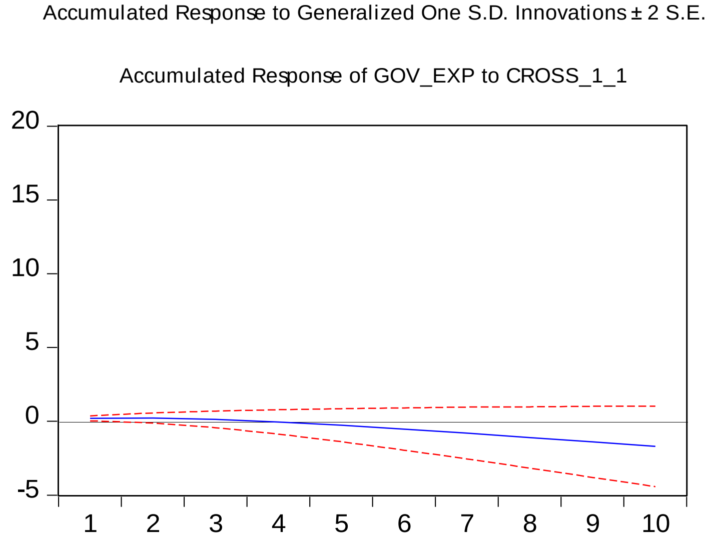
In this section we will examine the effects of oil volatility on government spending in non-democratic countries. The issue here is that the decision-making process is different with only one or a limited number of decision makers who control the whole oil production and distribution process. This releases them from any accountability to the population at large or any consideration for their welfare. The decision-making lines are shorter which may provide an advantage in the event of an economic shock. The non-democratic countries are analysed first, and this is followed by the introduction of a proxy for democratic attributes which allows a comparison to be made between the two paradigms.

7.3.1 Cross_1_1 (OilV_aut1dem0)

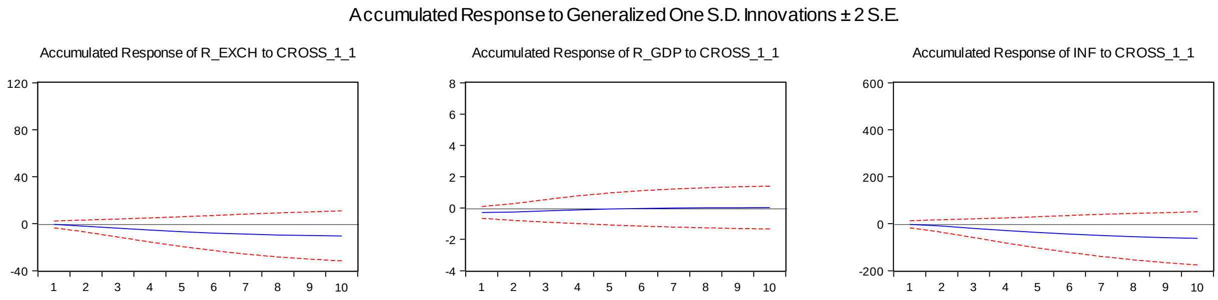
As shown in Fig. 7.7, the findings indicate that an increase in oil price volatility leads to a small rise in GOV_EXP, as a percentage of GDP, within the first three periods of shock through a direct channel in non-democratic countries, while the GOV_EXP, as a percentage of GDP, will be lower than the rate before the shock (see PGIRFs of Appendix D.7). This result may be related to the behavior of the government in these countries that keeps its absolute spending value when there is oil price uncertainty, and due to the negative effects on economic growth, but there will be a lack of financial resources after several periods owing to the non-optimal institutional mechanism in these economies. Therefore, the government enforces a contractionary policy by reducing expenditures, which in turn leads to a fluctuating response of government expenditure, as a percentage of GDP.

Figure 7.7. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on government spending in non-Democratic countries

Direct effects



Indirect effects



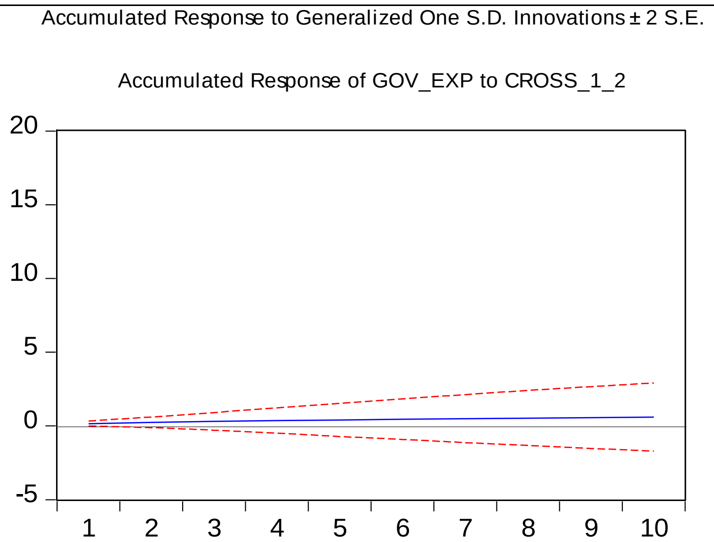
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= (OilV_aut1dem0), GOV_EXP= government spending

7.3.2 Cross_1_2 (OilrevenueV_aut1dem0)

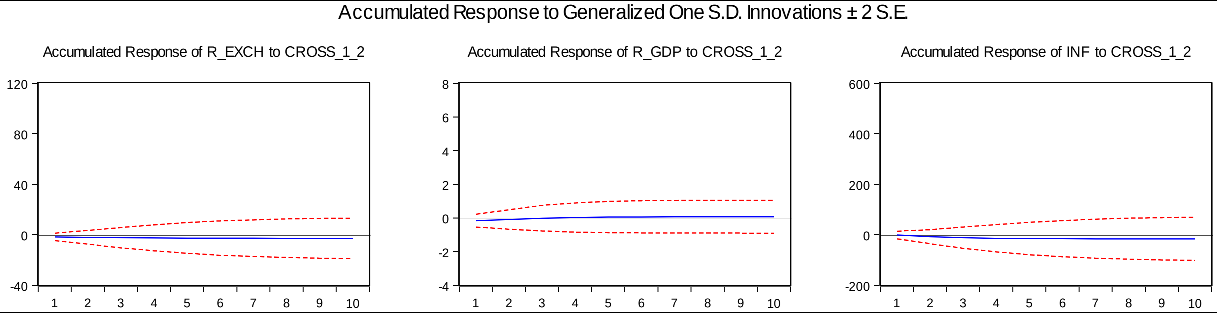
As can be seen, the response of GOV_EXP, as a percentage of GDP, to a positive shock of oil revenue volatility, is positive in non-democratic countries (see PGIRFs of Appendix D.8). As the indirect effective channels are inactive, and there is not any significant change in economic growth when responding to oil revenue uncertainty, there will be a rise in the absolute value of government spending leading to an increase in the share of government expenditure in these countries.

Figure 7.8. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on government spending in non-Democratic countries

Direct effects



Indirect effects



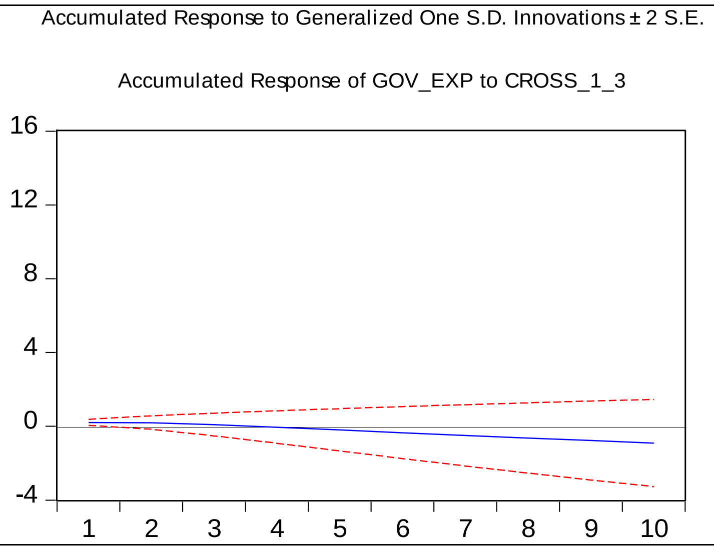
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, GOV_EXP= government spending

7.3.3 Cross_1_3 (OilrentsV_aut1dem0)

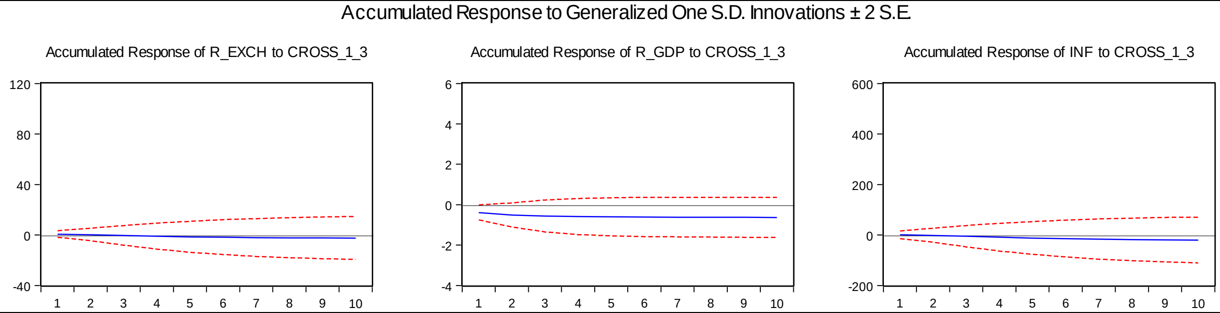
The results related to oil rent volatility are identical to the case of oil price volatility (see PGIRFs of Appendix D.9). It means that GOV_EXP, as a percentage of GDP, shows a fluctuating response to oil rent volatility, and that the indirect effect channels are inactive.

Figure 7.9. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on government spending in non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut1dem0, GOV_EXP= government spending

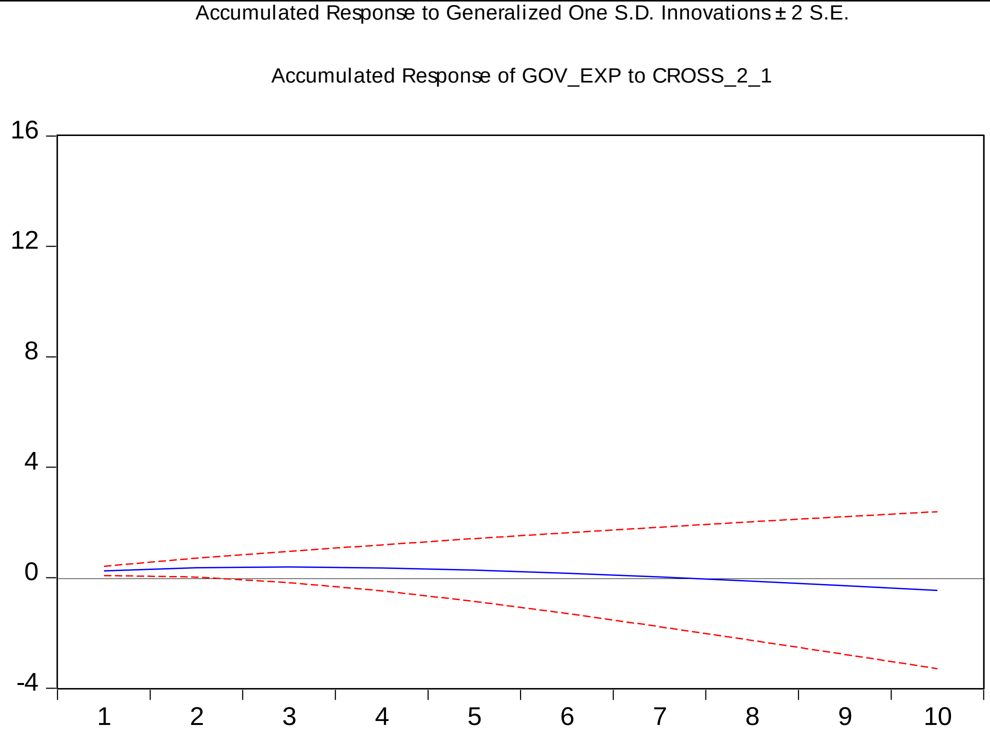
7.3.4 Cross_2_1 (OilV_aut1dem0xrreg)

Using multiplicative variables of xrreg and considering the degree of constraints on the executive in relation to oil volatility, a standard deviation shock to oil price volatility results in a fluctuating response of GOV_EXP, as a percentage of GDP (as seen in the previous case) (see PGIRFs of Appendix D.10). However, as the rise occurred during the first six periods after the GOV_EXP shock then the decline was slower.

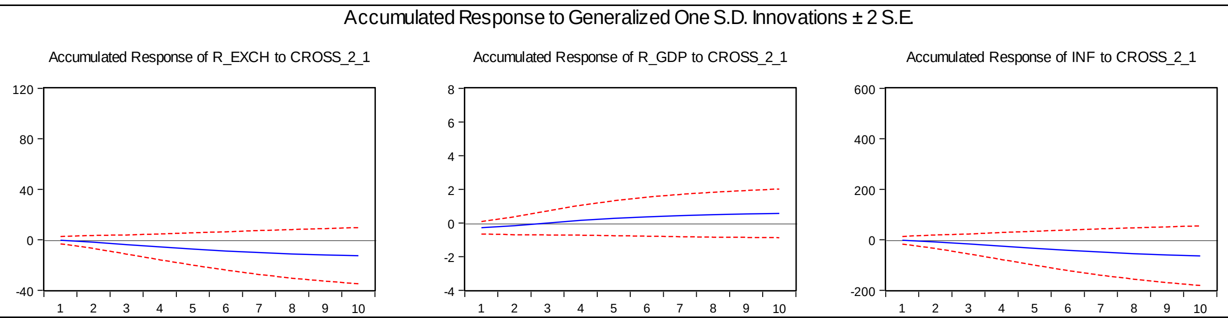
Considering the xrreg, a variable that allows the influence of the interaction of oil price, revenue and rent volatility with institutional quality and serves as a proxy to measure the degree of democratic characteristics in non-democratic governments, the response of GOV_EXP, as a percentage of GDP, in non-democratic countries, is similar to the response in democratic states.

Figure 7.10. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on government spending in non-Democratic countries

Direct effects



Indirect effects



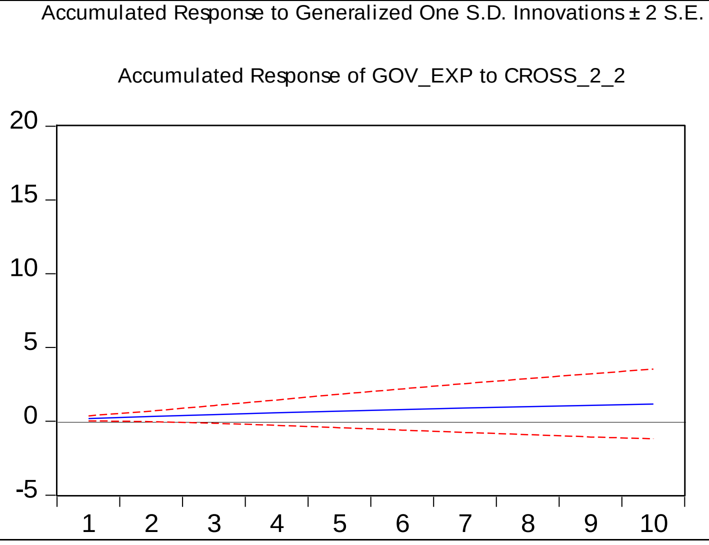
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut0dem1, GOV_EXP= government spending

7.3.5 Cross_2_2 (OilrevenueV_aut1dem0xrreg)

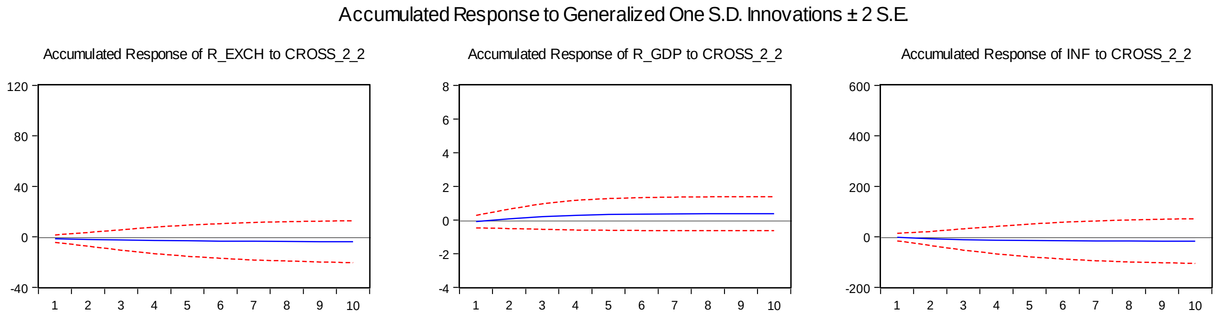
In Fig. 7.11, the impact of a standard deviation of a positive shock to oil revenue volatility has been shown in non-democratic countries by including democratic characteristics (xrreg) in the estimator (see PGIRFs of Appendix D.11). The main point is that an increase in oil revenue volatility leads to an increase in the share of GOV_EXP (as in the previous case without xrreg), but the difference is that the share of GOV_EXP is greater towards the latter part of the time curve.

Figure 7.11. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg)on government spending in non-Democratic countries

Direct effects



Indirect effects



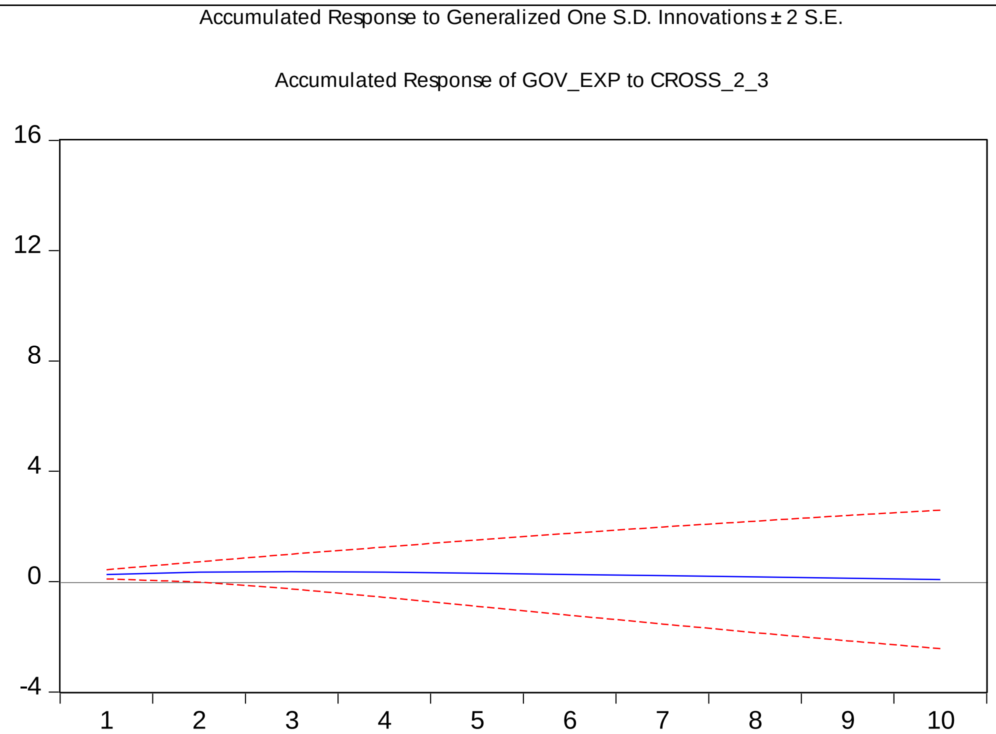
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut1dem0, GOV_EXP= government spending

7.3.6 Cross_2_3 (OilrentsV_aut1dem0xrreg)

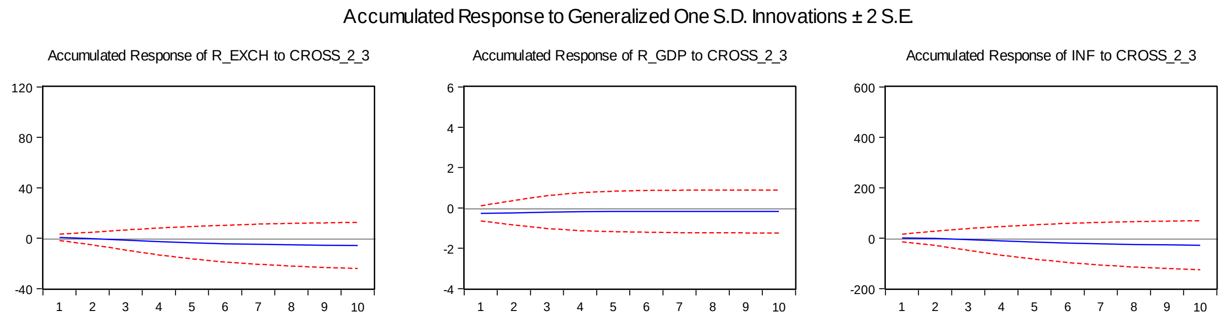
Using multiplicative variables of xrreg, inclusive of the degree of constraint on the executive in non-democratic countries in relation to the effect of oil volatility on the share of GOV_EXP, it can be seen that a standard deviation shock to oil rent volatility does not exert any major response (see PGIRFs of Appendix D.12). The xrreg interaction variable which provides for democratic characteristics seen in non-democratic governments, the response of GOV_EXP, as a percentage of GDP is similar to the response of this variable in democratic countries.

Figure 7.12. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg)on government spending in Non-democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentV_aut1dem0, GOV_EXP= government spending

7.4 Overall comparison between democratic/ non-democratic countries

Examining the oil volatility shocks in democratic and non-democratic countries, the main results are as follows.

There was a steady increase in government expenditure, as a percentage of GDP, in responding to oil volatility shocks in democratic countries, whilst in non-democratic states there was a stable response to oil revenue shocks and fluctuating responses to oil price and oil rent volatility with these being positive in early periods and then becoming negative.

Multiplying the xrreg variable by the oil volatility proxy proved that the more democratic the attributes are in the government of non-democratic countries, the greater the similarity to democratic states is the response of government expenditure, as a percentage of GDP, to oil volatility.

Arezeki and Van der Ploeg (2010) found that the resource curse was more apparent in countries with poor institutions and a less developed fiscal policy framework. This is evident from the results which indicate that the more democratic countries with better institutions and a greater degree of fiscal infrastructure had a more positive response to oil volatility shocks. The results also show that there is a convergence in response as the two groups of states move closer to the democratic norm. Moshiri (2015) explains that one of the hallmarks of quality institutions in oil countries is the existence of savings mechanisms to reduce the risk of volatility and this would be a positive response, together with a counter cyclical fiscal policy. However, the nature of a number of non-democratic regimes, particularly OPEC members, make them less susceptible to pursuing a democratic paradigm due to their absolute control of both the political and economic levers of power. This view is supported by Tornell and Lane (1999) who found that the more powerful the interest groups the more they were able to dictate policy including that relating to wealth distribution. In other words, they were able to control the process of financial extraction to suit their own ends in what has been described as the voracity effect. Erbil (2011) suggests that adopting countercyclical financial policies that smooths government spending, when referring to the nature of oil exporting countries that are constantly facing oil volatility. Therefore, they require strong institutions, greater transparency and a higher-level of bureaucracy which will also reduce the voracity effect. However, he finds that such policies are only seen in the developing economies suggesting that a greater degree of democracy is required before such solutions will be available. Plumper and Martin (2003) find that with the rise of democracy, the share of government spending on the economy and the supply of public services increases. Thus, the more democratic the country the greater is the effect of institutions in determining policy that results in diversification and growth and the lower is the effect of rents as a driver of decision making. This suggests that the more democratic the state the more likely it is to provide policies that reduce the effect of volatility which is a conclusion suggested by the results obtained.

In the next section, this study will examine the effects of oil volatility shocks on government spending components for the two groups of countries under study. Accordingly, the behaviors of three different components of government spending can be seen.

7.5 Democratic countries and disaggregated government spending (education, military and health)

After examining the effects of oil volatility on government expenditures in democratic and non-democratic countries, in this section, by separating the components of government expenditures, we now examine how the military, health and education expenditures (which, according to the statistical evidence presented in Chapter 4, are the main components of government spending) are affected by oil volatility in how democratic countries. This is followed, in Section 7.6, by the same analysis and discussion in relation to non-democratic countries. By comparing the results, in the final section, we will be able to identify the effect of volatility on the economic and political landscape in both sectors and compare and contrast the results to determine the differing response to volatility and the effect on government expenditure.

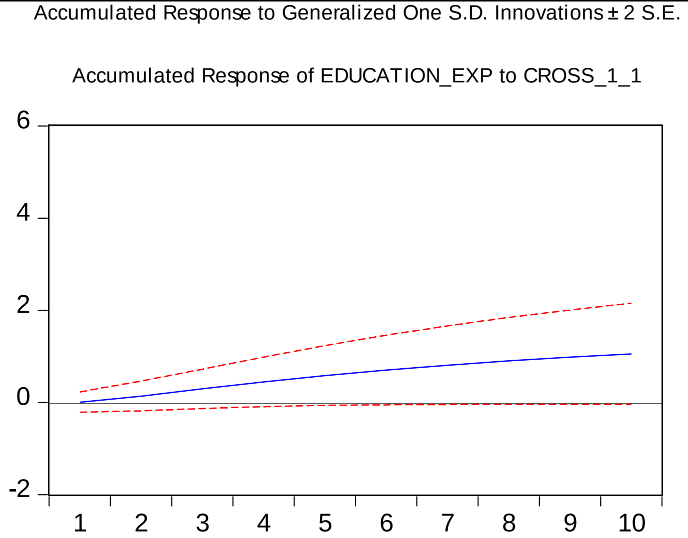
7.5.1 Cross_1_1 (OilV_aut0dem1) and disaggregated government spending

7.5.1.1 Cross_1_1 (OilV_aut0dem1) and education expenditure

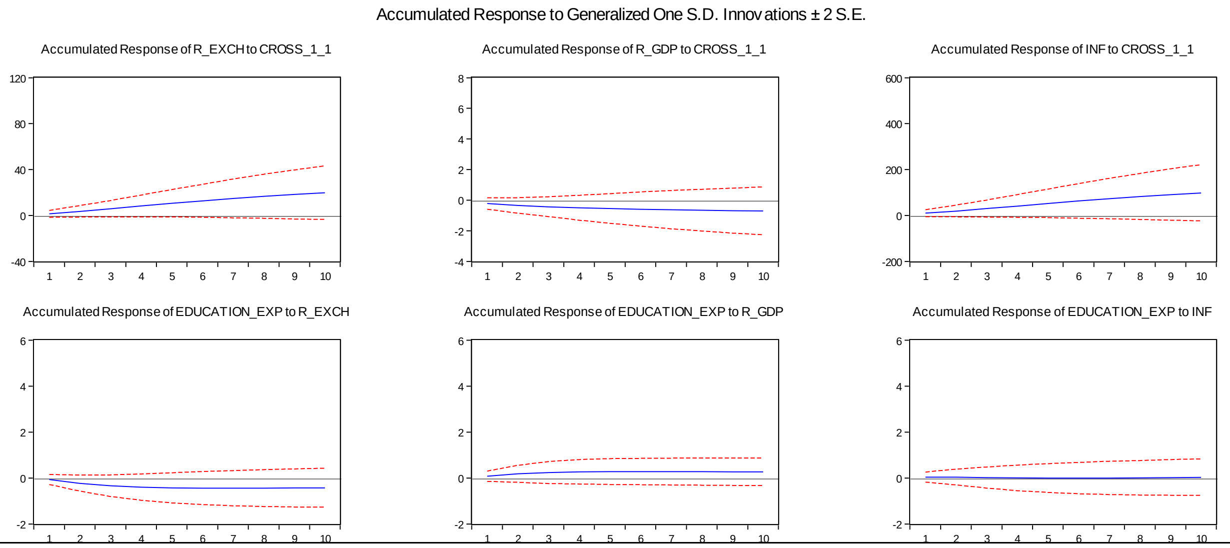
In the group of democratic countries, oil price volatility shock does not lead to a decline in Education_EXP, as a percentage of GDP, through the direct channel, because economic growth is reduced as a result of an increase in oil price uncertainty, therefore, there will be an increase in Education_EXP, as a percentage of GDP, due to the fixed absolute value of these expenditures (see PGIRFs of Appendix D.13). However, it will be observed that through the indirect channel of the exchange rate there is a negative influence of oil price uncertainty on Education_EXP, as a percentage of GDP, as seen in Fig. 7.13. Additionally, the resulting oil price uncertainty is accompanied by the increase in the exchange and inflation rate in the democratic countries. Thus, an increase in both these measures leads to a contrary result to that seen in the direct channel, albeit, that the result for the inflationary effect is not significant. These results imply that this leads to a reduction in Education_EXP, as a percentage of GDP with the rationale being that this is because of a combination of rising inflationary expectations, uncertainty and risk, currency devaluation and lower capital accumulation which were examined in the previous section (5.2.1.3). Therefore, whilst the results in the indirect channels suggest otherwise, in real terms there is no absolute reduction, as a percentage of GDP, in education expenditure in democratic countries due to its stability within a framework of GDP reduction.

Figure 7.13. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1)on education expenditure in Democratic countries

Direct effects



Indirect effects



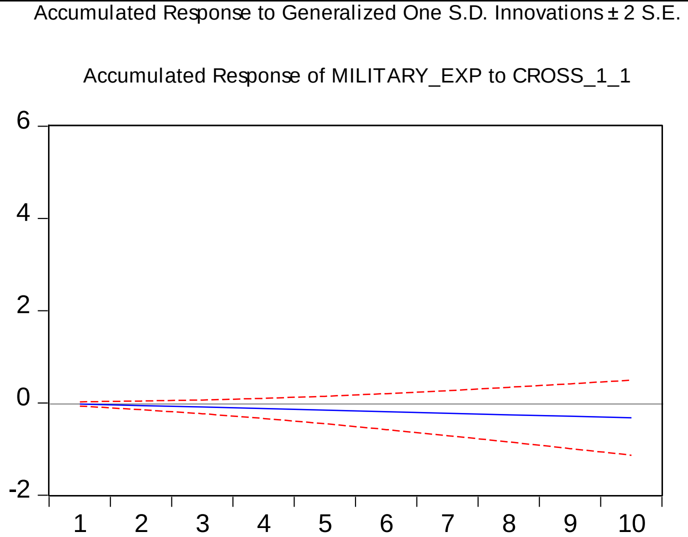
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, EDUCATION_EXP= education expenditure

7.5.1.2 Cross_1_1 (OilV_aut0dem1) and military expenditure

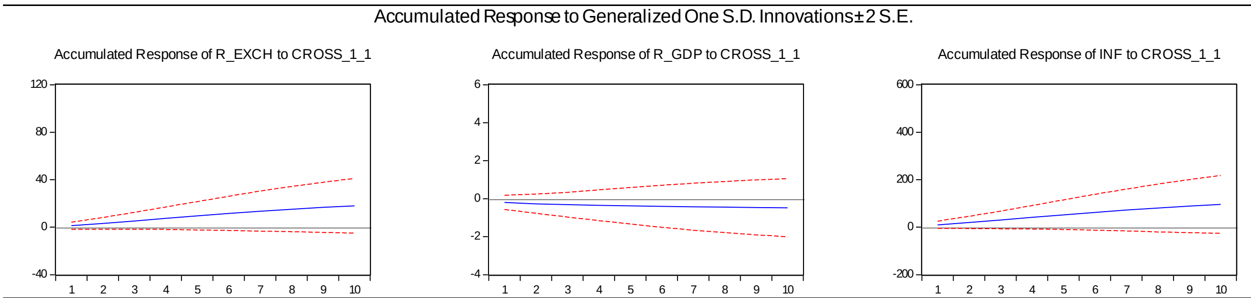
The share of Militrary_EXP, as a percentage of GDP, is not affected by oil price volatility in democratic countries (see PGIRFs of Appendix D.14). It means that when there is a change in price uncertainty in the oil market, military expenditure is modified in relation to its scale to GDP, which indicates that the volume in the economy remains constant in these countries.

Figure 7.14. Cumulative generalised impulse responses of Cross_1_1 ((OilV_aut0dem1))on military expenditure in Democratic countries

Direct effects



Indirect effects



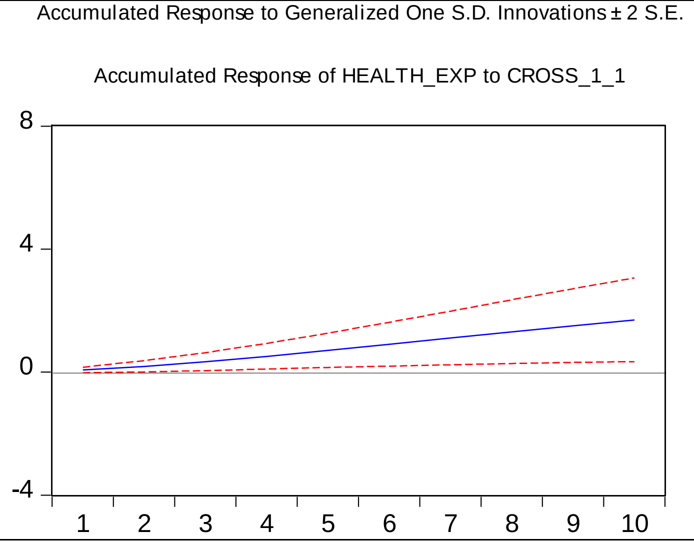
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, MILITARY_EXP= military expenditure

7.5.1.3 Cross_1_1 (OilV_aut0dem1) and health expenditure

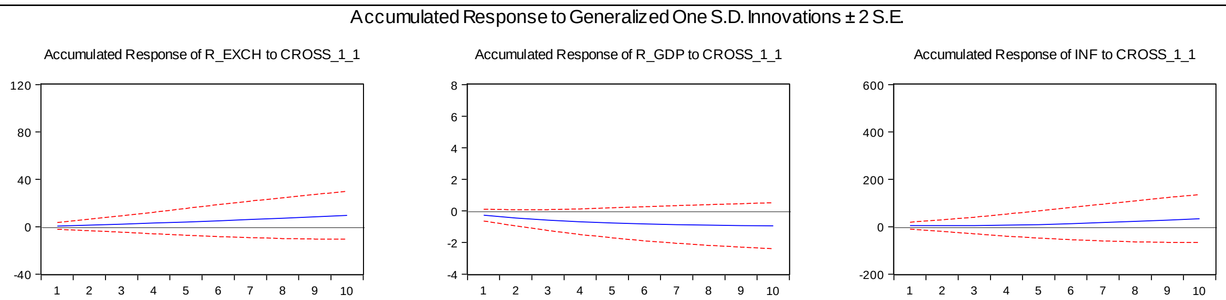
Health expenditure has the same response as education expenditure in democratic countries (see PGIRFs of Appendix D.15). There is an increase in health expenditure following an oil price shock in these countries. As economic growth responds negatively to oil price shock, so the absolute value of health spending does not change, and this leads to an increase in health expenditure, as a percentage of GDP, in these countries. Therefore, health spending remains static despite oil price uncertainty in democratic countries.

Figure 7.15. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, HEALTH_EXP= health expenditure

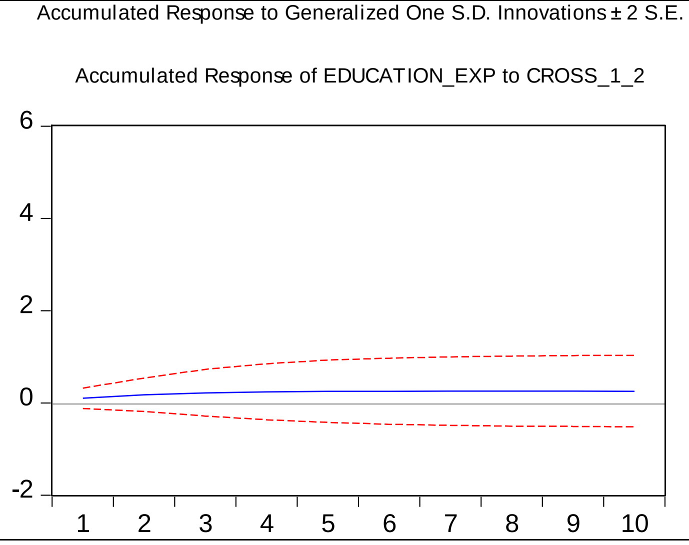
7.5.2 Cross_1_2 (OilrevenueV_aut0dem1) and disaggregated government spending

7.5.2.1 Cross_1_2 (OilrevenueV_aut0dem1) and education expenditure

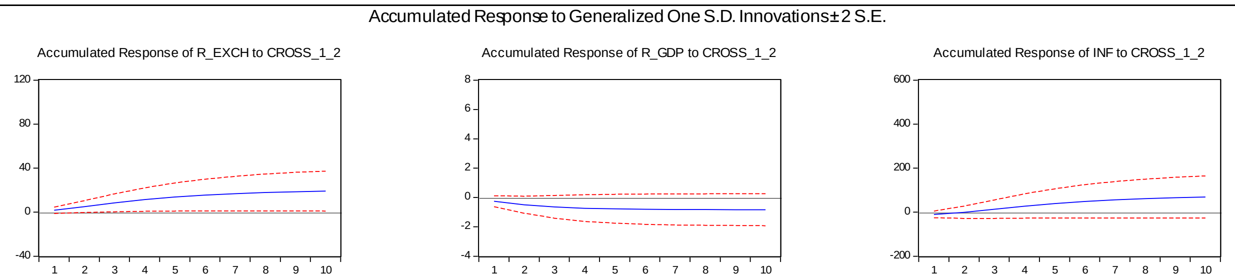
In relation to oil revenue volatility in democratic countries, there is no significant effect on Education_EXP, as a percentage of GDP, through either the direct or indirect channels (see PGIRFs of Appendix D.16). As there is no change in economic growth, then education expenditure is fixed in its response to oil revenue volatility in these countries.

Figure 7.16. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on education expenditure in Democratic countries

Direct effects



Indirect effects



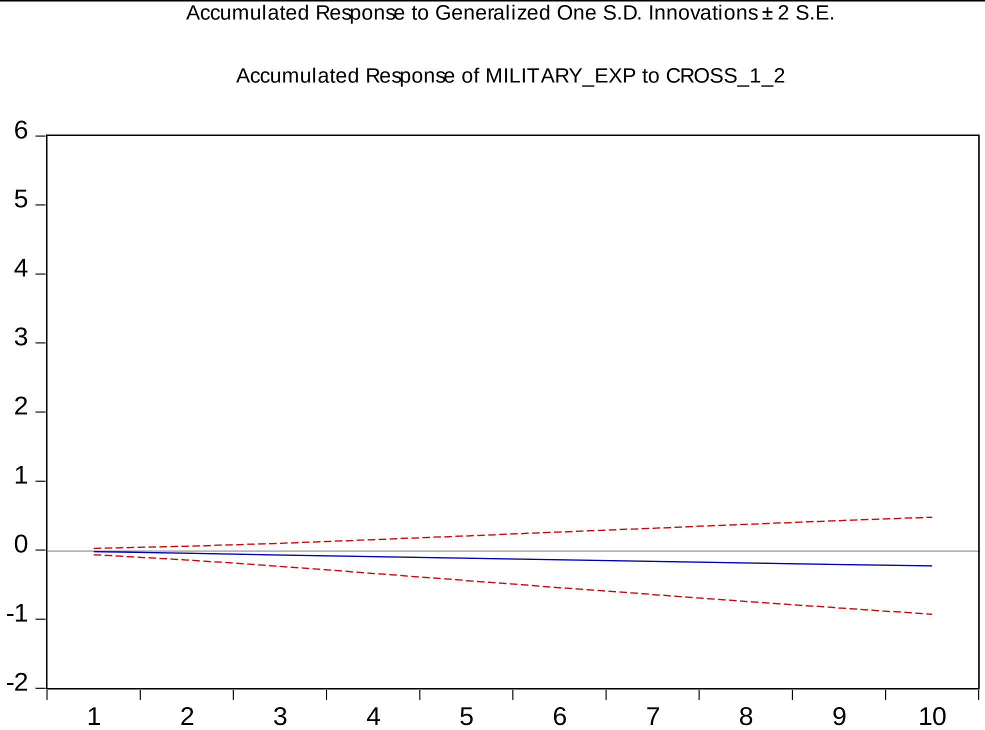
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, EDUCATION_EXP= education expenditure

7.5.2.2 Cross_1_2 (OilrevenueV_aut0dem1) and military expenditure

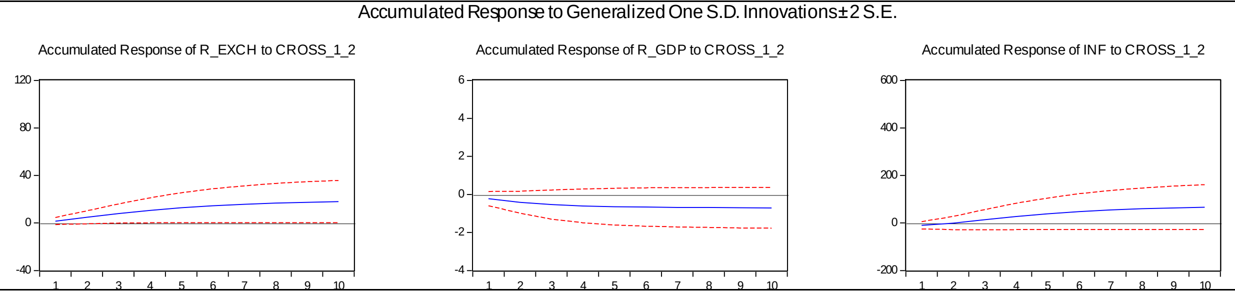
It is observed that, in democratic countries, Military_EXP, as a percentage of GDP, shows the same characteristics as Education_EXP (see PGIRFs of Appendix D.17). Therefore, there is no change in military expenditure due to oil revenue uncertainty.

Figure 7.17. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on military expenditure in Democratic countries

Direct effects



Indirect effects



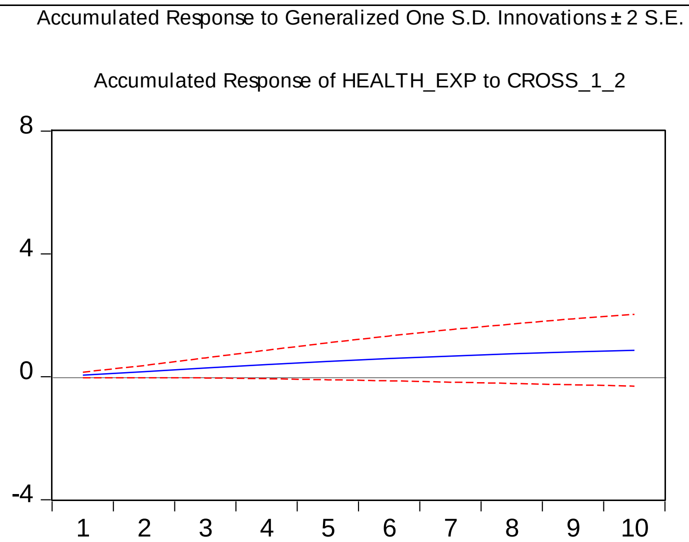
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, MILITARY_EXP= military expenditure

7.5.2.3 Cross_1_2 (OilrevenueV_aut0dem1) and health spending

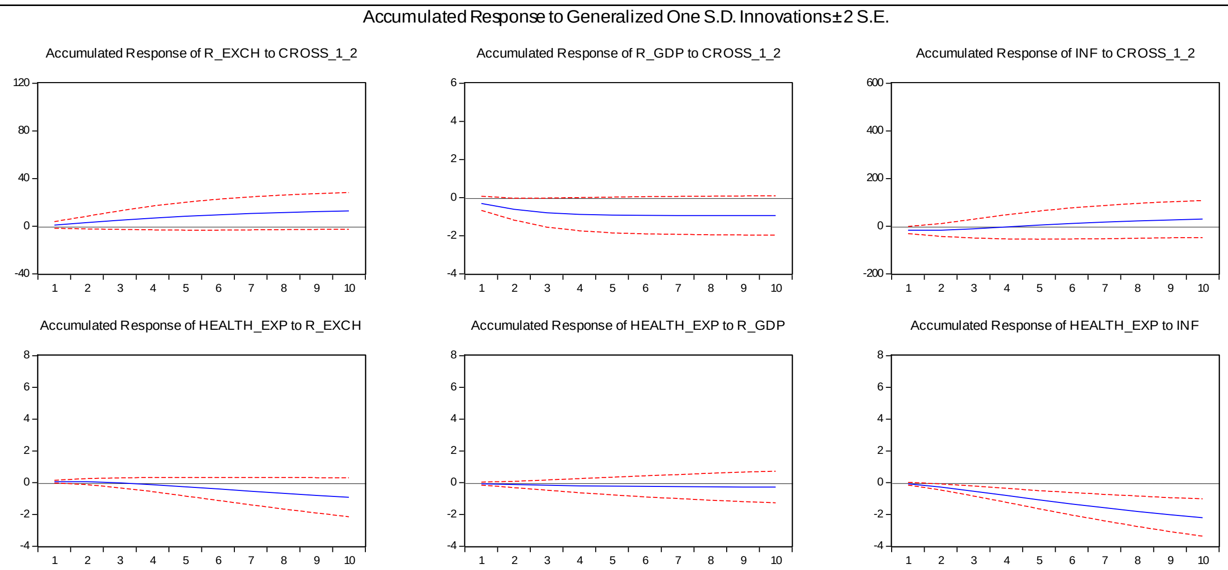
According to Fig. 7.18, the results suggest that oil revenue volatility exercises a direct positive effect on Health_EXP, as a percentage of GDP, in democratic countries, and this increase occurs through its growing absolute value because there is no significant change in economic growth (see PGIRFs of Appendix D.18). However, there are two indirect impacts within the exchange rate and inflation channels. The uncertainty of oil revenue leads to a rise in the exchange rate and inflation. However, the higher exchange rate and inflation leads to lower Health_EXP, as a percentage of GDP, in these countries. It seems that increased health expenditures occur through a mechanism exogenous of the domestic economy of these countries.

Figure 7.18. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, HEALTH_EXP= health expenditure

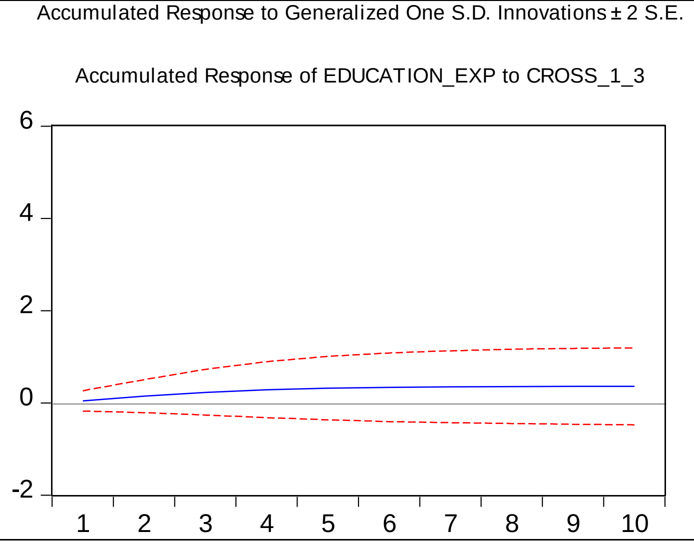
7.5.3 Cross_1_3 (OilrentV_aut0dem1) and disaggregated government spending

7.5.3.1 Cross_1_3 (OilrentsV_aut0dem1) and education expenditure

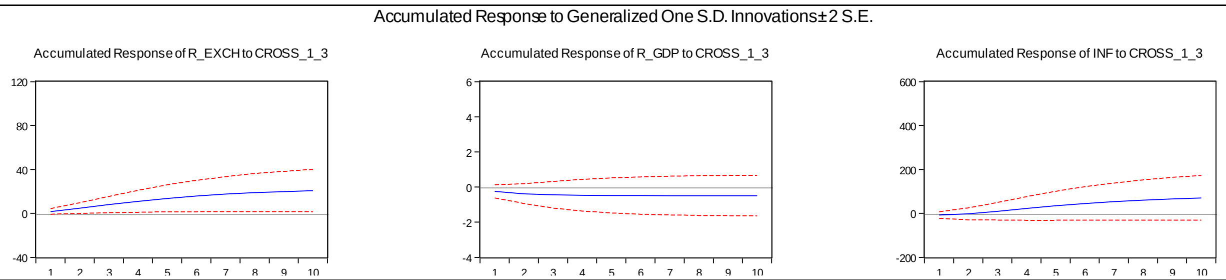
When oil rent volatility is considered, the results of the impulse response functions are similar to the results of oil revenue volatilities with similar mechanisms in existence (see PGIRFs of Appendix D.19). There is no significant change in Education_EXP, as a percentage of GDP, through direct or indirect channels.

Figure 7.19. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on education expenditure in Democratic countries

Direct effects



Indirect effects



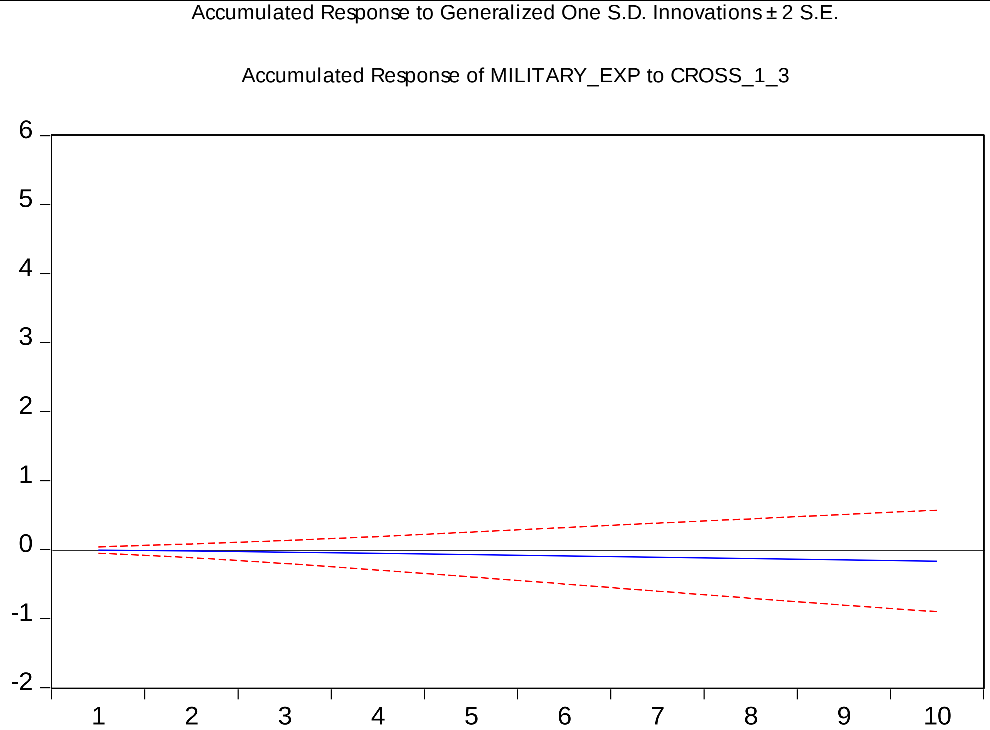
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, EDUCATION_EXP= education expenditure

7.5.3.2 Cross_1_3 (OilrentsV_aut0dem1) and military expenditure

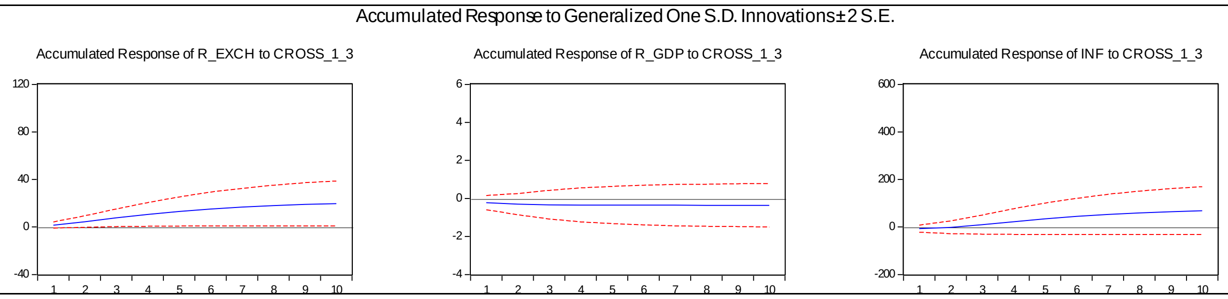
In terms of Military_EXP, as a percentage of GDP, an increase in oil rent volatility does not lead to any significant effect in the economic indicators of democratic countries (see PGIRFs of Appendix D.20). These results are similar to those seen previously.

Figure 7.20. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on military expenditure in Democratic countries

Direct effects



Indirect effects



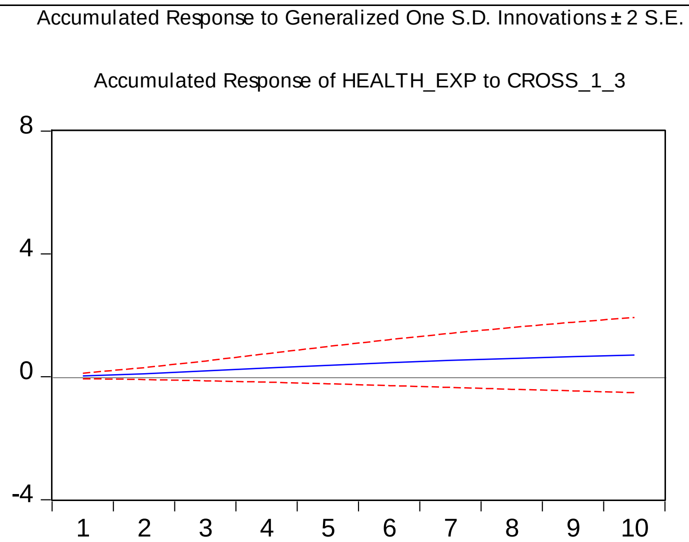
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, MILITARY_EXP= military expenditure

7.5.3.3 Cross_1_3 (OilrentsV_aut0dem1) and health expenditure

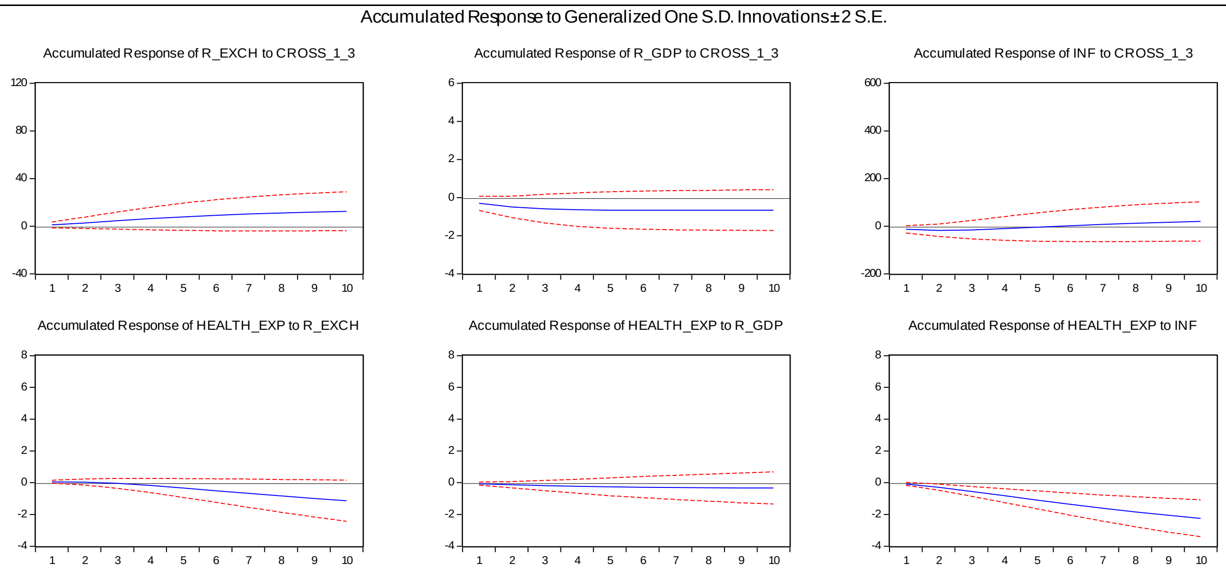
In Fig. 7.21, the results of Health_EXP, as a percentage of GDP, shows that the findings of the impulse response functions in relation to oil rent volatility are similar to the results of oil revenue volatility with similar mechanisms in existence (see PGIRFs of Appendix D.21). In other words, the direct impact of an oil rent volatility shock on Health_EXP, as a percentage of GDP, is positive, while there are indirect inflation and exchange rate channels by which oil rent volatility impacts Health_EXP negatively. The economic mechanisms of such changes were examined in the previous section.

Figure 7.21. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, HEALTH_EXP= health expenditure

7.5.4 Cross_2_1 (OilV_aut0dem1xrreg) and disaggregated government spending

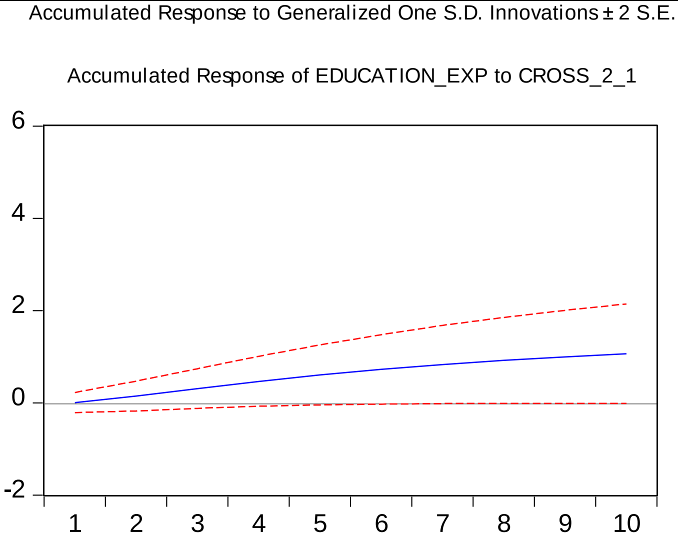
Now, the effects of oil volatility shocks on disaggregated government expenditure components are examined by considering the constraints on the executive with the inclusion of the xrreg variable.

7.5.4.1 Cross_2_1 (OilV_aut0dem1xrreg) and education expenditure

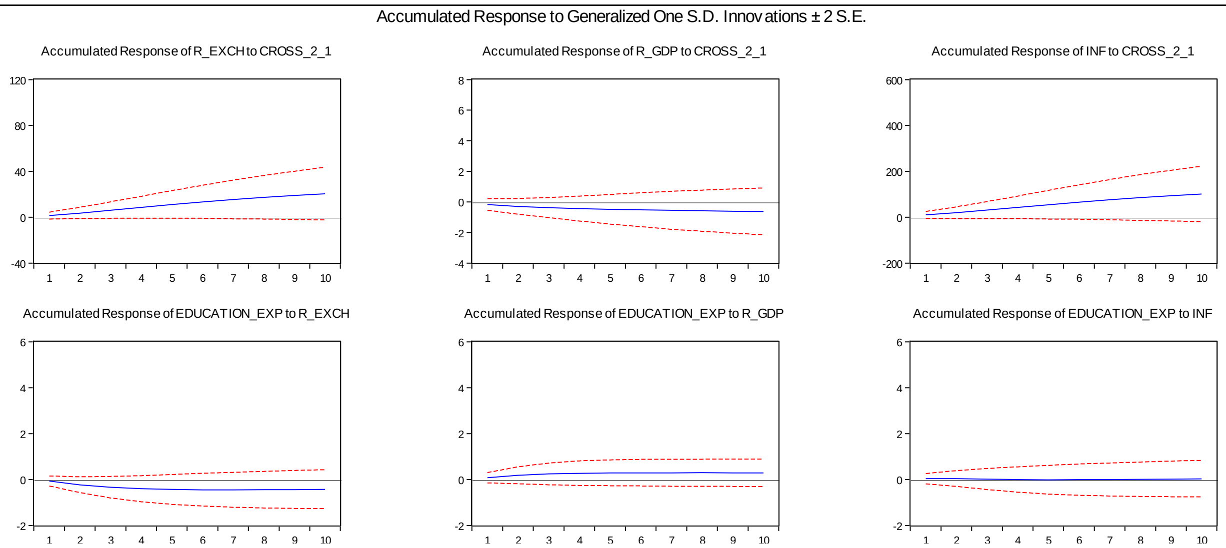
In terms of education spending, the results obtained are similar to that seen when xrreg has not been added (see PGIRFs of Appendix D.22). This study observes that oil price volatility exercises a direct positive effect on Education_EXP, as a percentage of GDP. However, there is an indirect negative effect via the exchange rate channel.

Figure 7.22. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on education expenditure in Democratic countries

Direct effects



Indirect effects



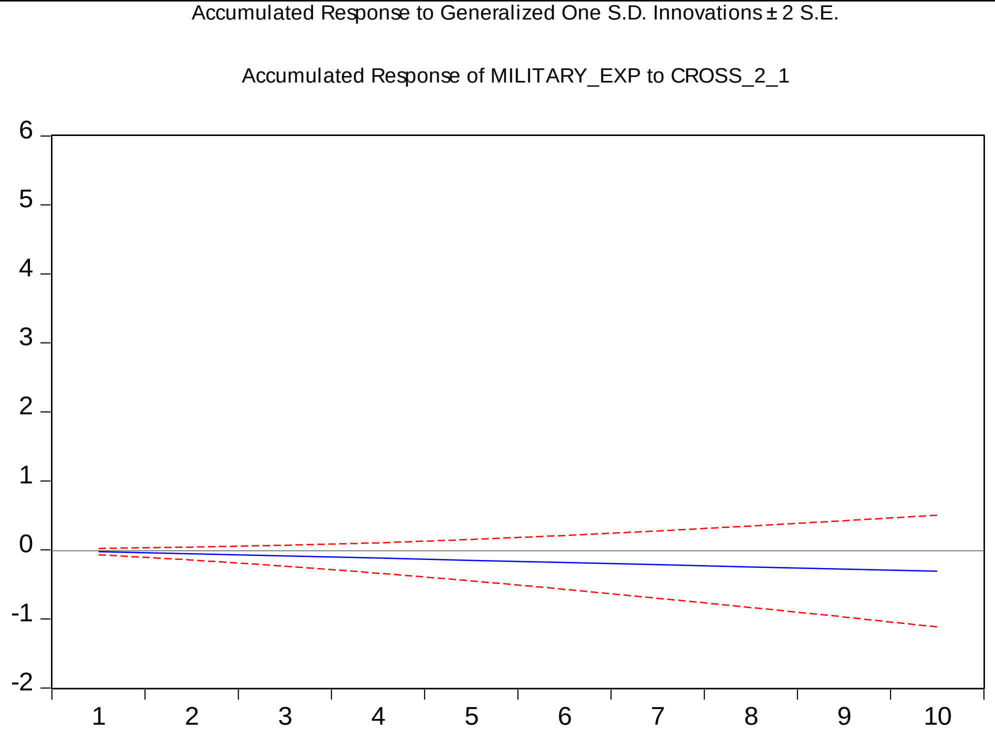
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut0dem1xrreg, EDUCATION_EXP= education expenditure

7.5.4.2 Cross_2_1 (OilV_aut0dem1xrreg) and military spending

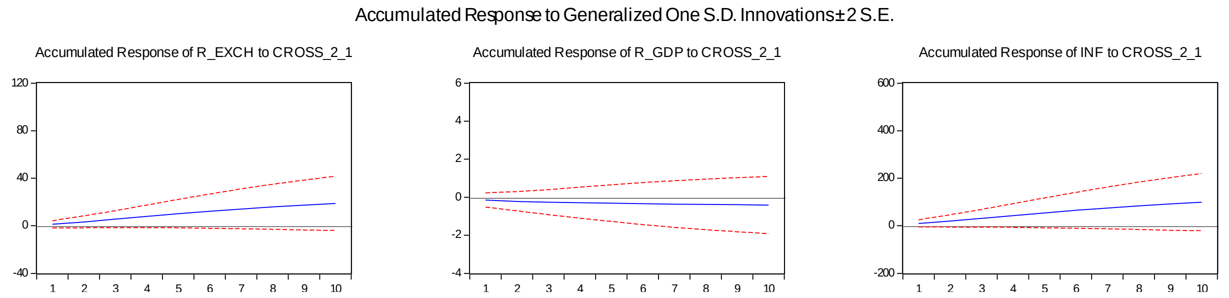
In terms of Military_EXP, the results obtained were similar to the case when xrreg was not included, therefore, the inclusion of the democratic proxy has not yielded a different result (see PGIRFs of Appendix D.23).

Figure 8.23. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg)on military expenditure in Democratic countries

Direct effects



Indirect effects



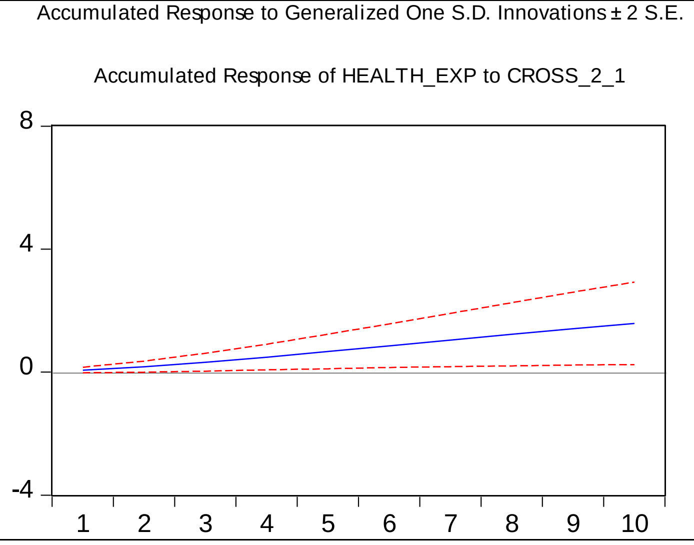
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut0dem1xrreg, MILITARY_EXP= military expenditure

7.5.4.3 Cross_2_1 (OilV_aut0dem1xrreg) and health expenditure

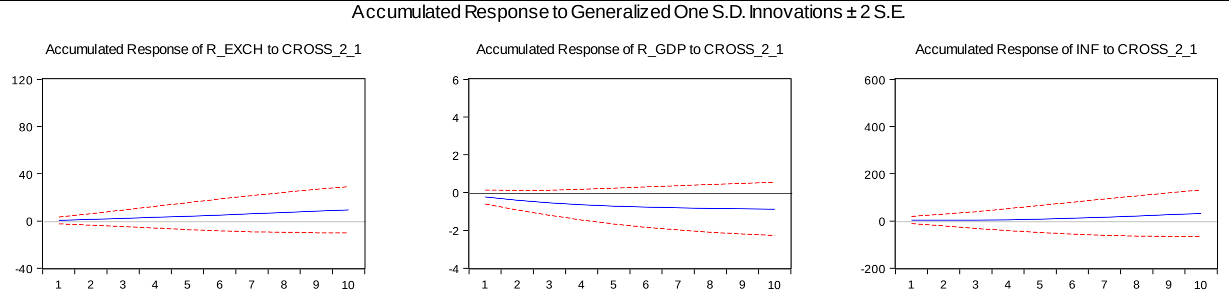
The similar results are for Health_EXP, in that it increases as a percentage of GDP (see PGIRFs of Appendix D.24). Therefore, a positive shock to oil price volatility led to an increase in Health_EXP as a result of the controlling constraints on the executive in democratic countries. The response rate was similar to that seen in the previous section.

Figure 7.24. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut0dem1xrreg, HEALTH_EXP= health expenditure

7.5.5 Cross_2_2 (OilrevenueV_aut0dem1xrreg) and disaggregated government spending

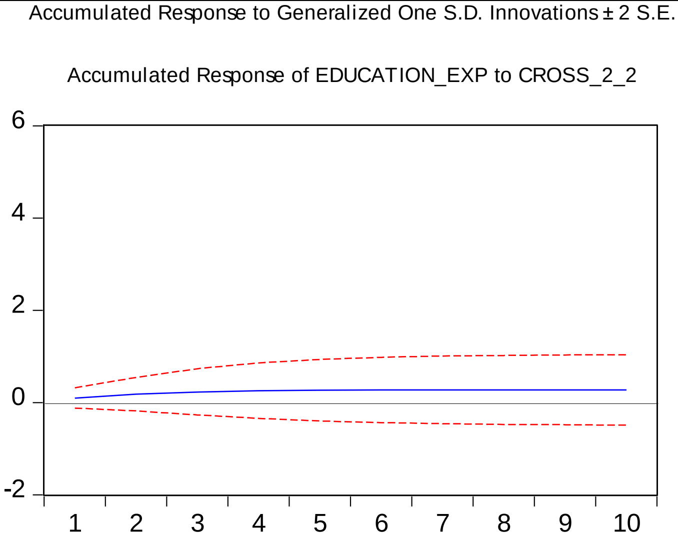
This part of study addresses oil revenue volatility in democratic countries with the inclusion of the xrreg variable.

7.5.5.1 Cross_2_2 (OilrevenueV_aut0dem1xrreg) and education expenditure

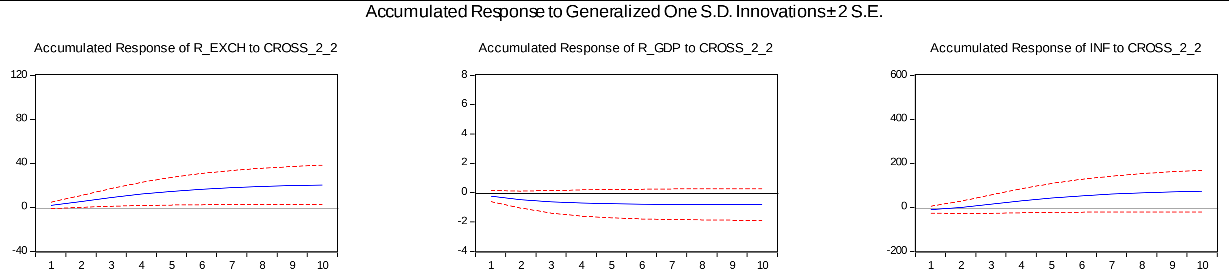
It can be seen that there is no change in oil revenue volatility compared to the previous results when the democracy proxy is added as a measure of the controlling constraint on the executive (see PGIRFs of Appendix D.25). Also, in this instance, education-expenditure, as a percentage of GDP, does not change.

Figure 7.25. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on education expenditure in Democratic countries

Direct effects



Indirect effects



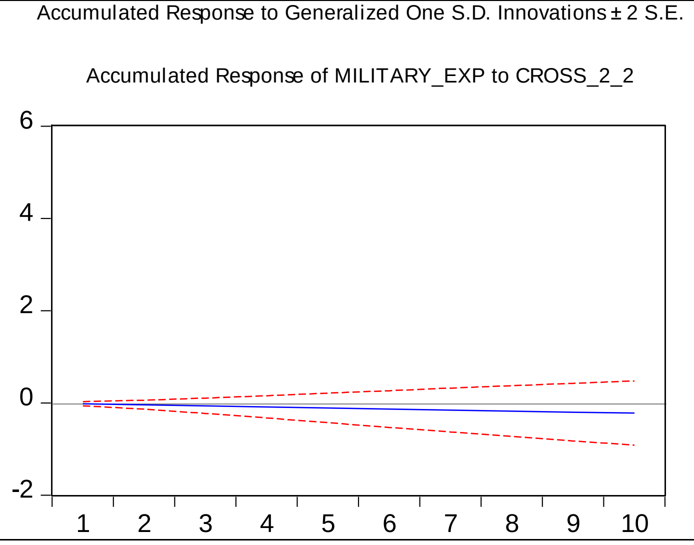
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut0dem1xrreg, EDUCATION_EXP= education expenditure

7.5.5.2 Cross_2_2 (OilrevenueV_aut0dem1xrreg) and military expenditure

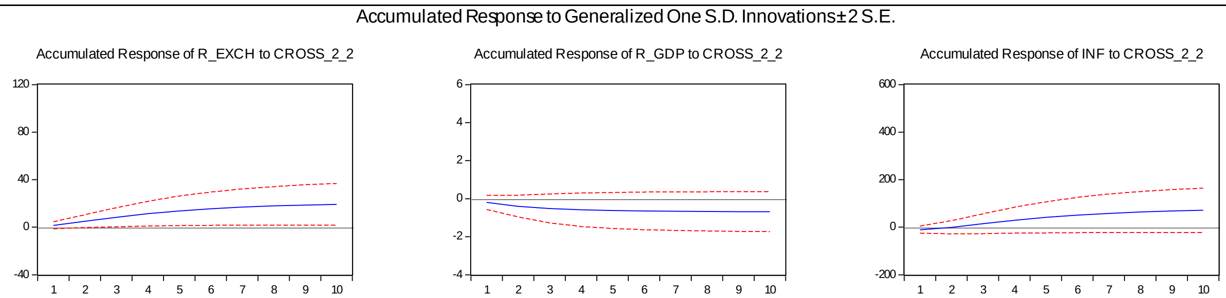
The similar results were obtained for the share of Military_EXP where oil revenue volatility does not exert any significant effect on military expenditure in democratic countries (see PGIRFs of Appendix D.26).

Figure 7.26. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on military expenditure in Democratic countries

Direct effects



Indirect effects



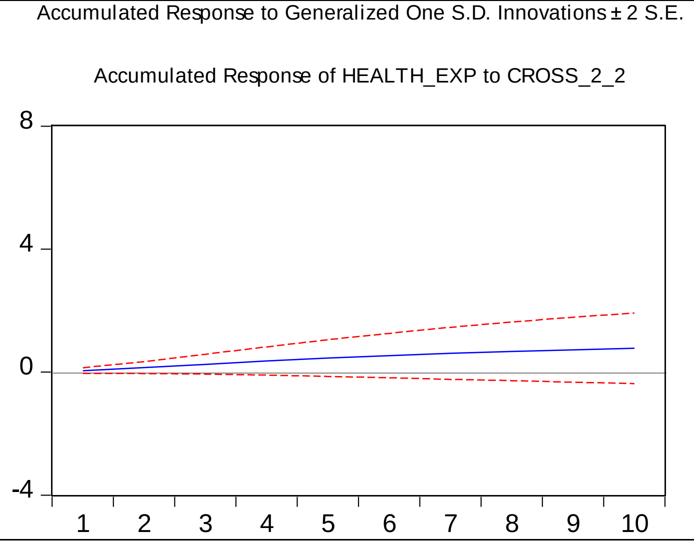
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut0dem1xrreg, MILITARY_EXP= military expenditure

7.5.5.3 Cross_2_2 (OilrevenueV_aut0dem1xrreg) and health expenditure

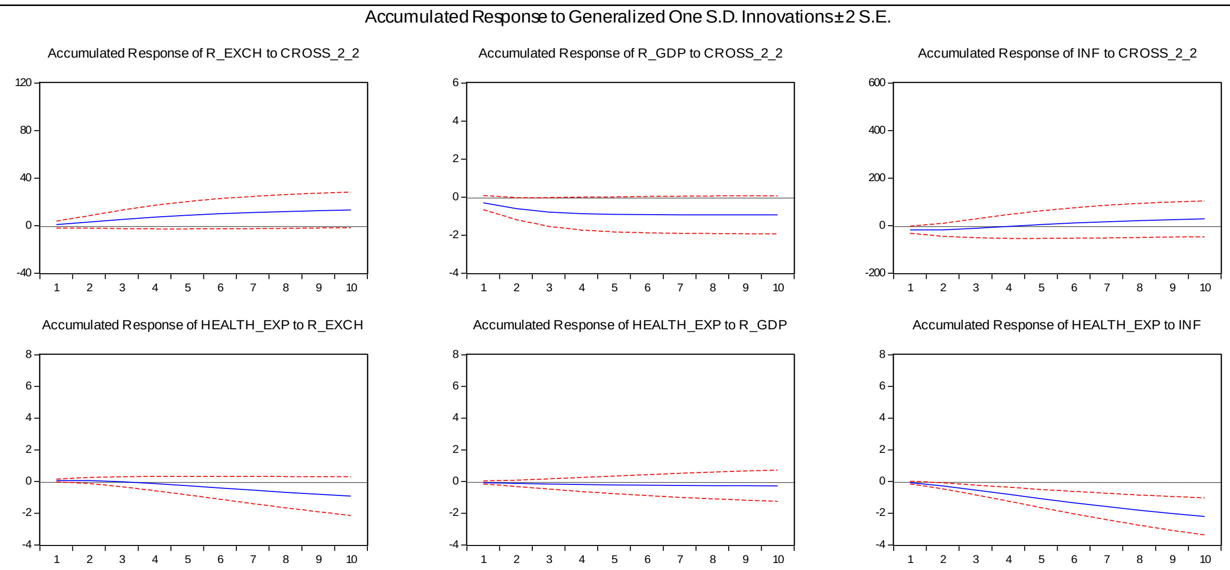
In comparison to the results seen without any measure of executive constraint there was no change in Health_EXP, as a percentage of GDP, in democratic countries, when an oil revenue shock was introduced (see PGIRFs of Appendix D.27). In this instance, this study observes that oil revenue volatility exercises a direct positive effect on Military_EXP, as a percentage of GDP. However, there is an indirect negative effect by which oil revenue volatility impacts Health_EXP via the exchange rate and inflation channels. These results are in line with results obtained when the xrreg variable was not included.

Figure 7.27. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut0dem1xrreg, HEALTH_EXP= education spending

7.5.6 Cross_2_3 (OilrentsV_aut0dem1xrreg) and disaggregated government spending

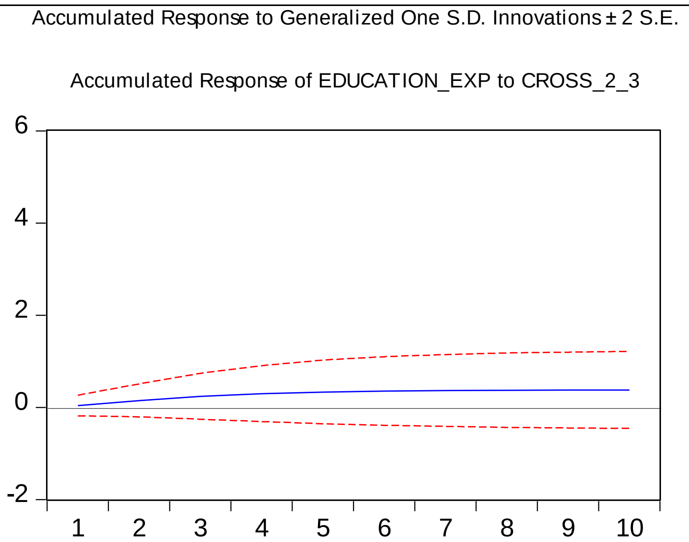
There was no difference in results obtained in democratic counties by adding the xrreg variable to examine the effects of oil rent volatility.

7.5.6.1 Cross_2_3 (OilrentsV_aut0dem1xrreg) and education expenditure

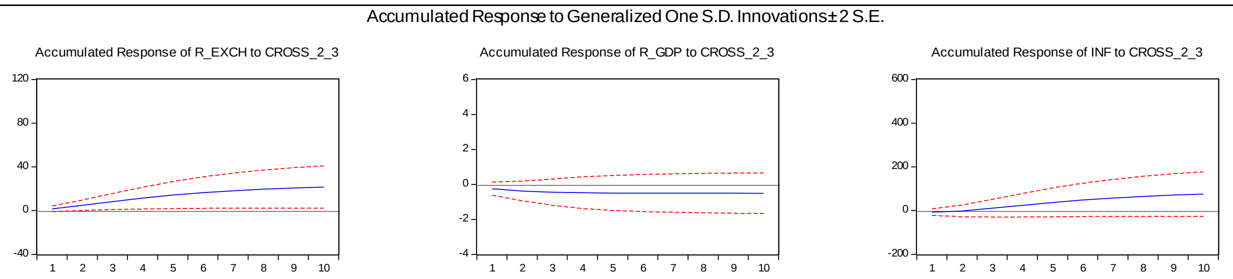
According to Fig. 7.28, this does not show any significant response of Education_EXP, as a percentage of GDP, to oil rent volatility in these countries (see PGIRFs of Appendix D.28).

Figure 7.28. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg)on education expenditure in Democratic countries

Direct effects



Indirect effects



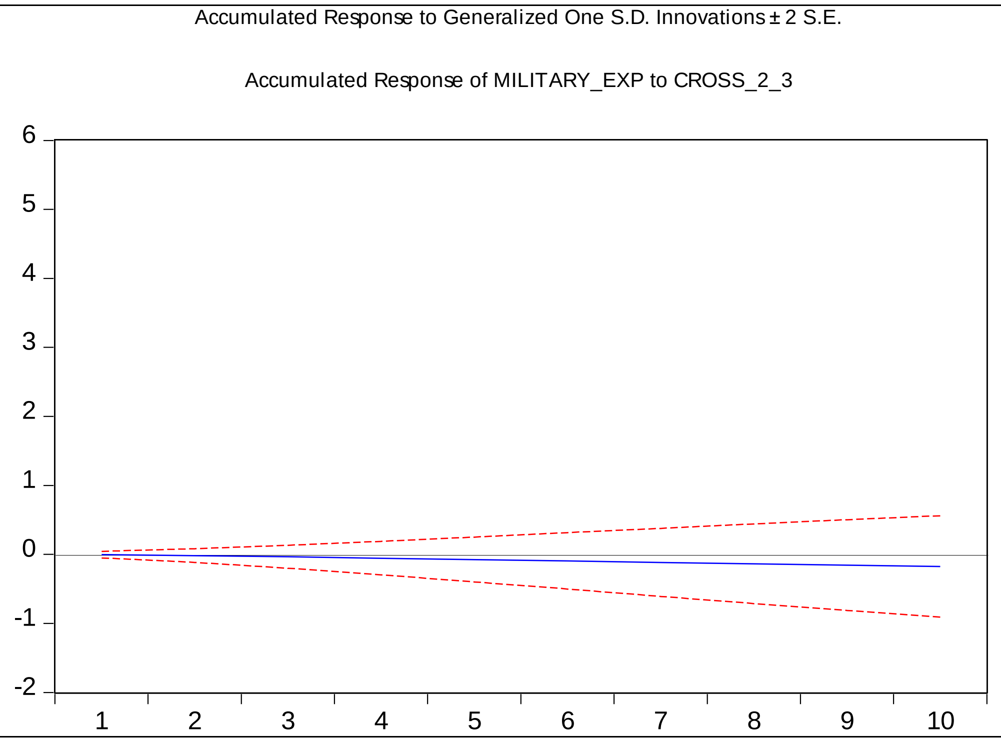
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut0dem1xrreg, EDUCATION_EXP= education expenditure

7.5.6.2 Cross_2_3 (OilrentsV_aut0dem1xrreg) and military spending

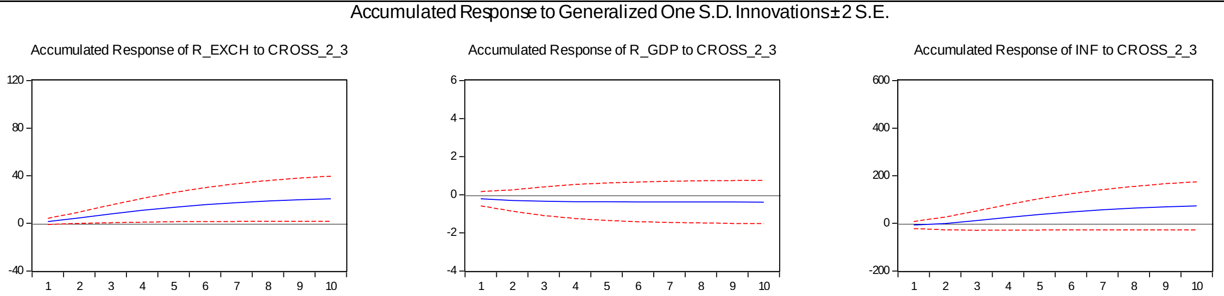
This study concentrates on the impact of oil rents volatility on Military_EXP in democratic countries (see PGIRFs of Appendix D.29). The findings show that the presence of xrreg variables did not lead to any significant results.

Figure 7.29. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on military expenditure in Democratic countries

Direct effects



Indirect effects



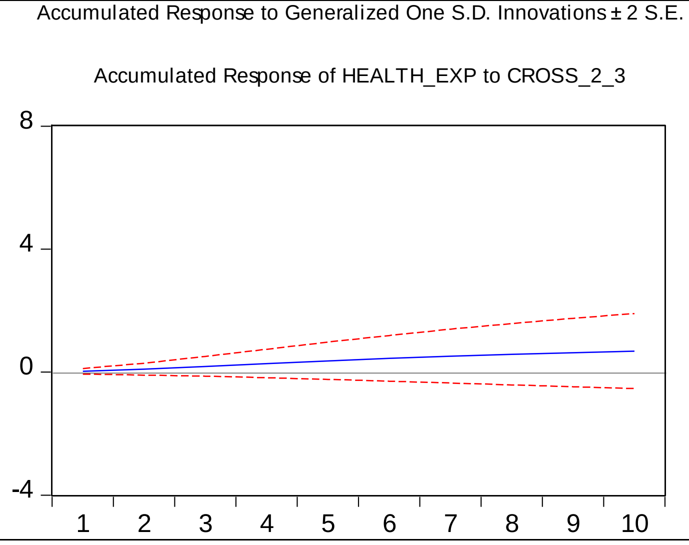
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut0dem1xrreg, MILITARY_EXP= military expenditure

7.5.6.3 Cross_2_3 (OilrentsV_aut0dem1xrreg) and health spending

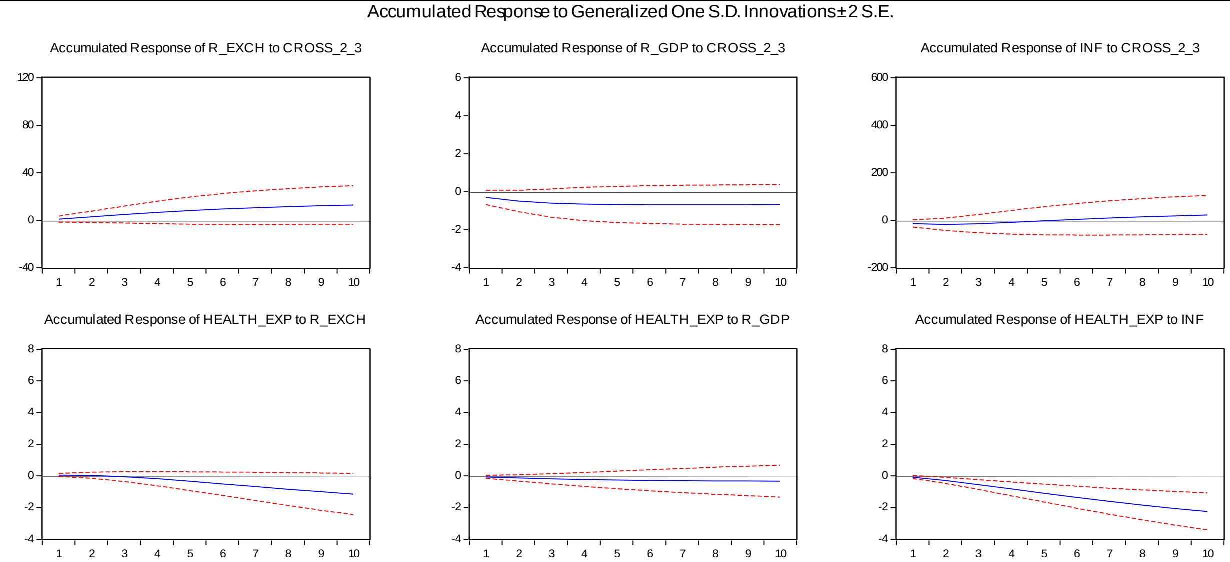
The results from Fig. 7.30 indicate that oil rent volatility exercises a direct positive effect on Health_EXP, as a percentage of GDP, in democratic countries; although, expenditure reduces when measured through the indirect inflation and exchange rate channels (see PGIRFs of Appendix D.30).

Figure 7.30. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on health expenditure in Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut0dem1xrreg, HEALTH_EXP= health expenditure

7.6 Non-Democratic countries and disaggregated government spending (education, military and health)

In this section, by distinguishing the components of government expenditures in non-democratic countries, we examine how the military, health and education expenditures in the countries in this category respond to oil volatility. We anticipate that by comparing the results of this and the previous section, we find significant evidence of how institutional quality, measured by the degree of democratisation, affects the impact of oil volatility on these expenditures.

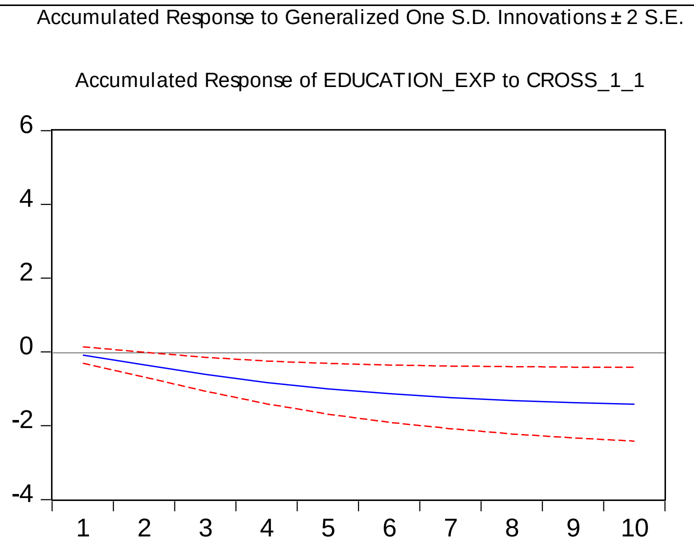
7.6.1 Cross_1_1 (OilV_aut1dem0) and disaggregated government spending

7.6.1.1 Cross_1_1 (OilV_aut1dem0) and education expenditure

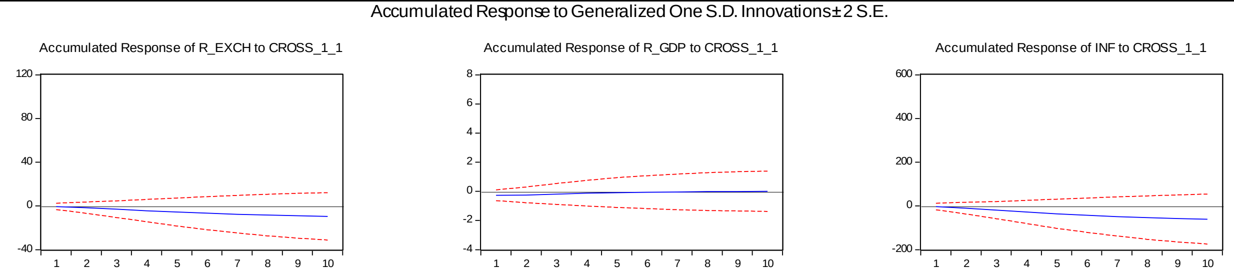
In Fig. 7.31, the impact of a standard deviation of a positive shock to oil price volatility is shown in non-democratic countries (see PGIRFs of appendix D.31). The response of Education_EXP, as a percentage of GDP, to a positive shock of oil price volatility, is negative in these countries. It is apparent that, governments reduce education expenditure, and allocate it to other sectors, when there is uncertainty in non-democratic countries.

Figure 7.31. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on education expenditure in non-Democratic countries

Direct effects



Indirect effects



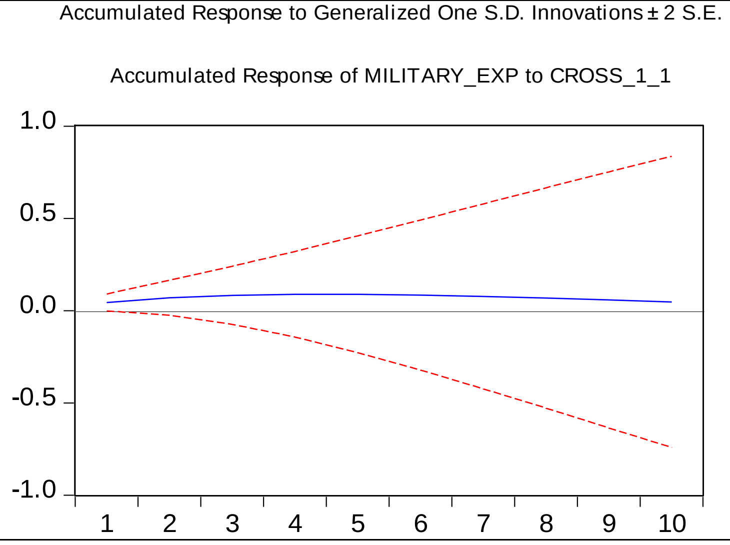
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, EDUCATION_EXP= education expenditure

7.6.1.2 Cross_1_1 (OilV_aut1dem0) and military

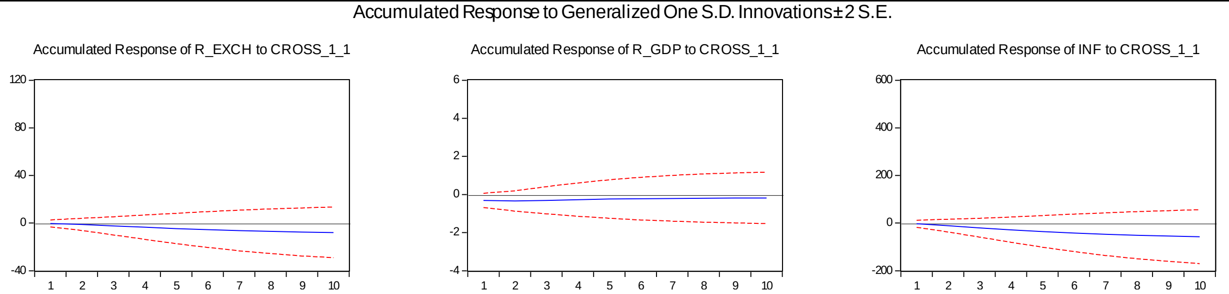
In contrast to the share of Education_EXP, oil price volatility, in the direct channel, leads to an increase in Military_EXP, as a percentage of GDP in non-democratic countries (see PGIRFs of Appendix D.32).

Figure 7.32. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on military expenditure in non-Democratic countries

Direct effects



Indirect effects



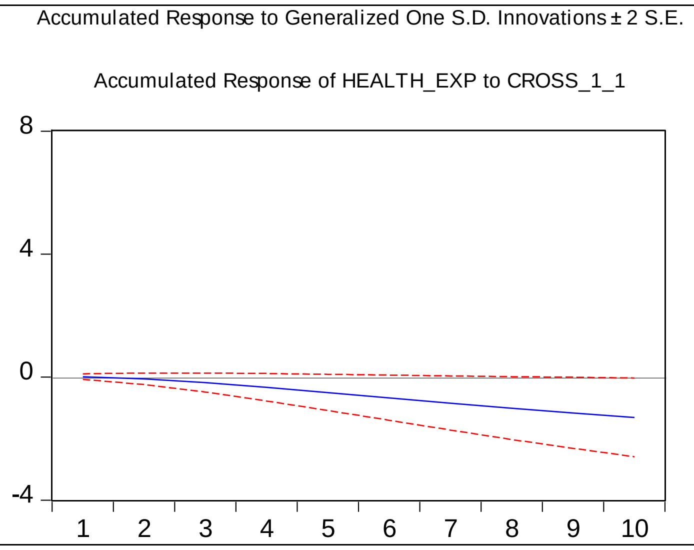
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, MILITARY_EXP= military expenditure

7.6.1.3 Cross_1_1 (OilV_aut1dem0) and health expenditure

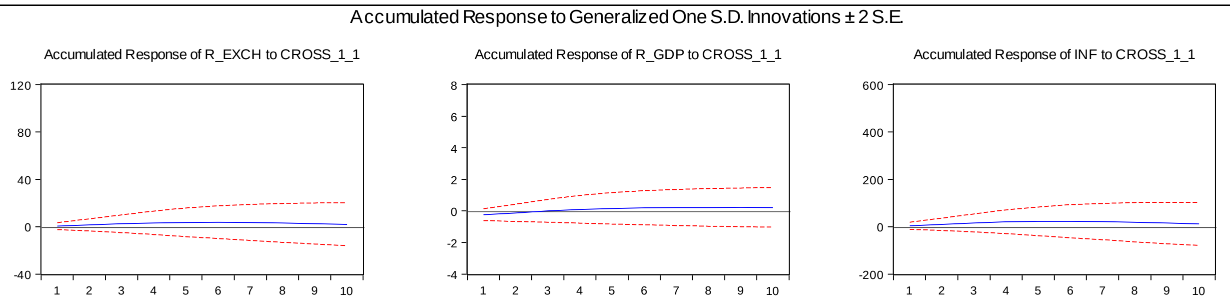
In non-democratic countries, a positive shock to oil price volatility leads to a reduction in Health_EXP via the direct channel, which is a similar result seen in relation to Education_EXP (see PGIRFs of Appendix D.33). The mechanisms for such a change in health expenditure were studied in the previous chapter.

Figure 7.33. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on health expenditure in non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, HEALTH_EXP= health expenditure

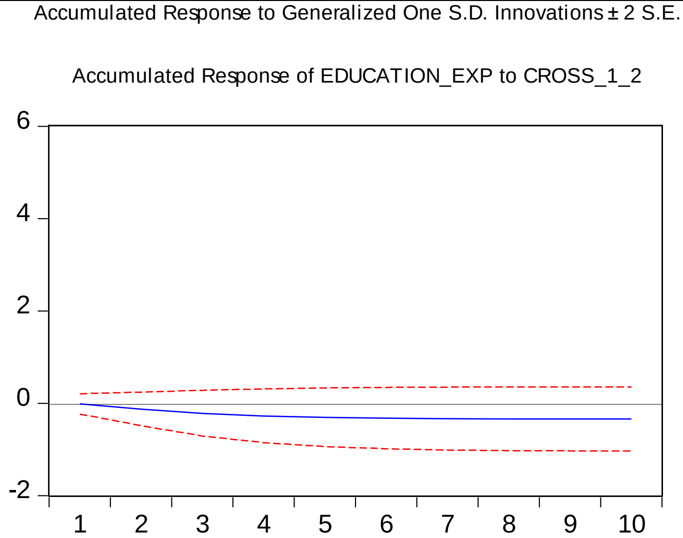
7.6.2 Cross_1_2 (OilrevenueV_aut1dem0) and disaggregated government spending

7.6.2.1 Cross_1_2 (OilrevenueV_aut1dem0) and education expenditure

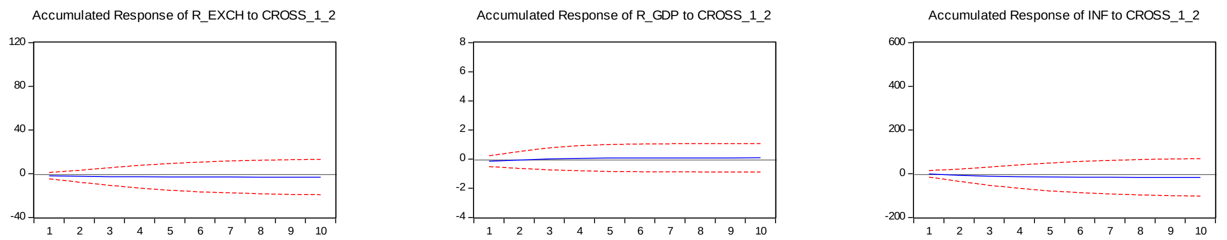
The findings from Fig. 7.34 indicate that an oil revenue volatility shock does not exert any significant direct or indirect effect on Education_EXP, as a percentage of GDP, in non-democratic countries (see PGIRFs of Appendix D.34). An increase in oil revenue volatility leads to a reduction in economic growth, therefore, any decline in education spending is a consequence of a reduction in GDP in these countries, so there is no change in the percentage of this variable.

Figure 7.34. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on education expenditure in non-Democratic countries

Direct effects



Indirect effects



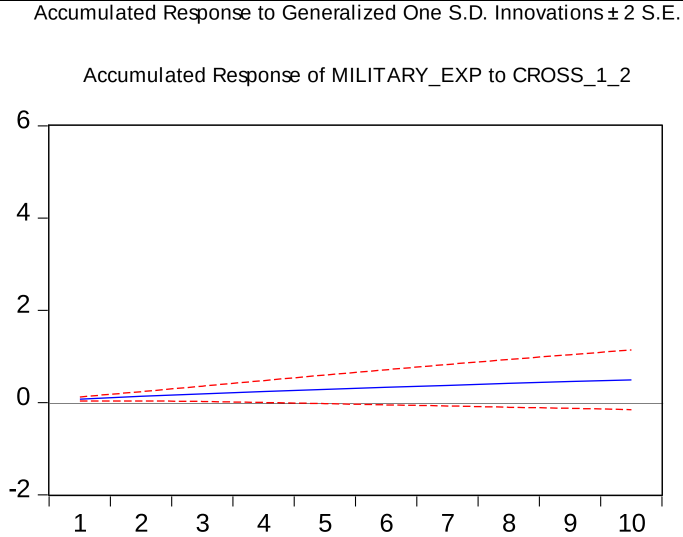
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= (OilrevenueV_aut1dem0), EDUCATION_EXP= education expenditure

7.6.2.2 Cross_1_2 (OilrevenueV_aut1dem0) and military expenditure

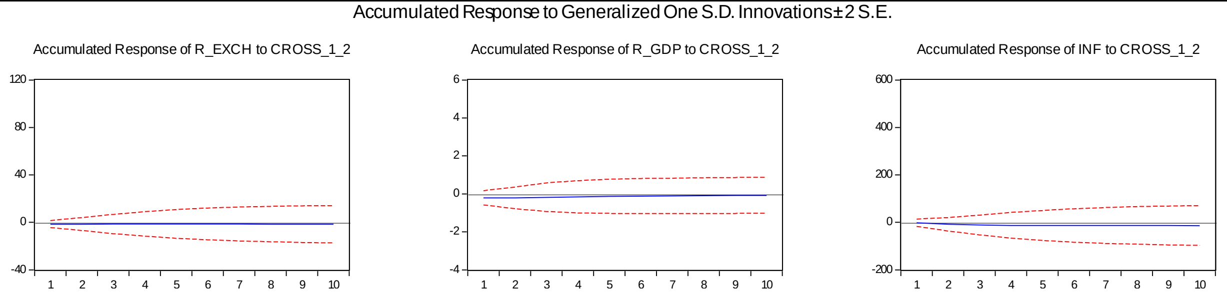
In terms of Military_EXP, as a percentage of GDP in non-democratic countries, oil revenue volatility leads to an increase in Military_EXP through the direct channel (see PGIRFs of Appendix D.35).

Figure 7.35. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on military expenditure in non-Democratic countries

Direct effects



Indirect effects



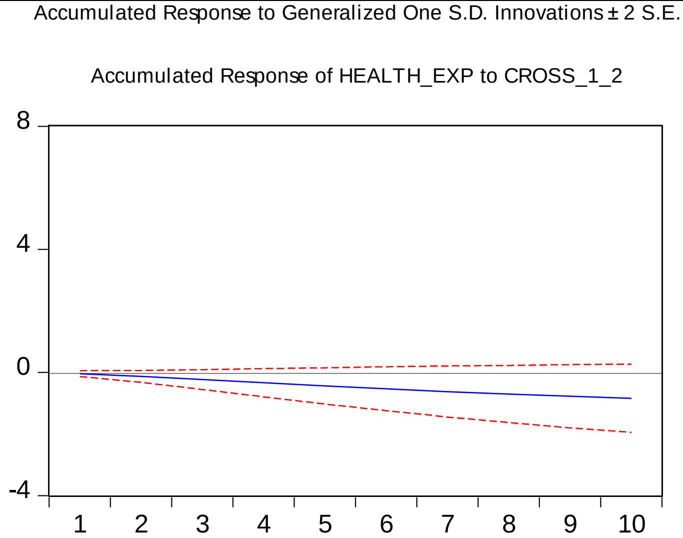
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, MILITARY_EXP= military expenditure

7.6.2.3 Cross_1_2 (OilrevenueV_aut1dem0) and health expenditure

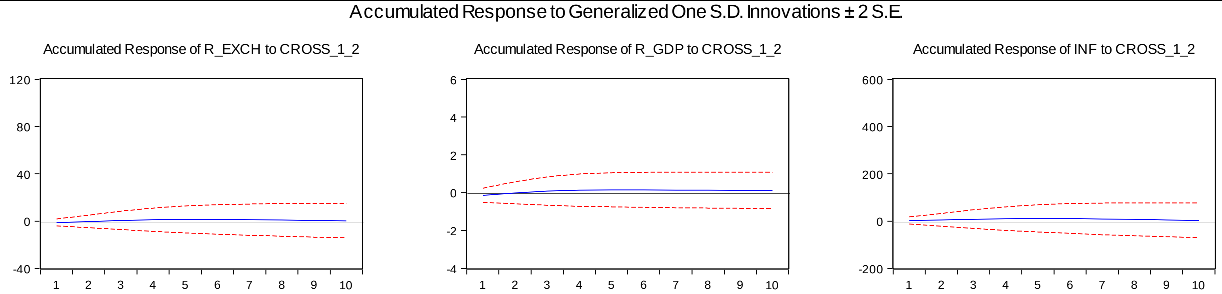
In non-democratic countries an oil revenue volatility shock leads to a reduction in Health_EXP, as a percentage of GDP, but only through the direct channel (see PGIRFs of Appendix D.36).

Figure 7.36. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on health expenditure in non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, HEALTH_EXP= health expenditure

7.6.3 Cross_1_3 (OilrentV_aut1dem0) and disaggregated government spending

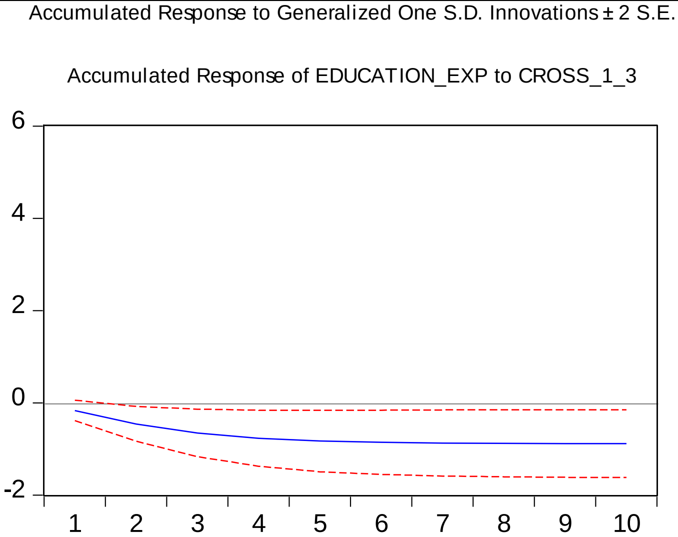
The direct and indirect effect of the oil rent volatility on disaggregated government expenditure is examined in non-democratic countries. The results are similar to those seen previously.

7.6.3.1 Cross_1_3 (OilrentsV_aut1dem0) and education expenditure

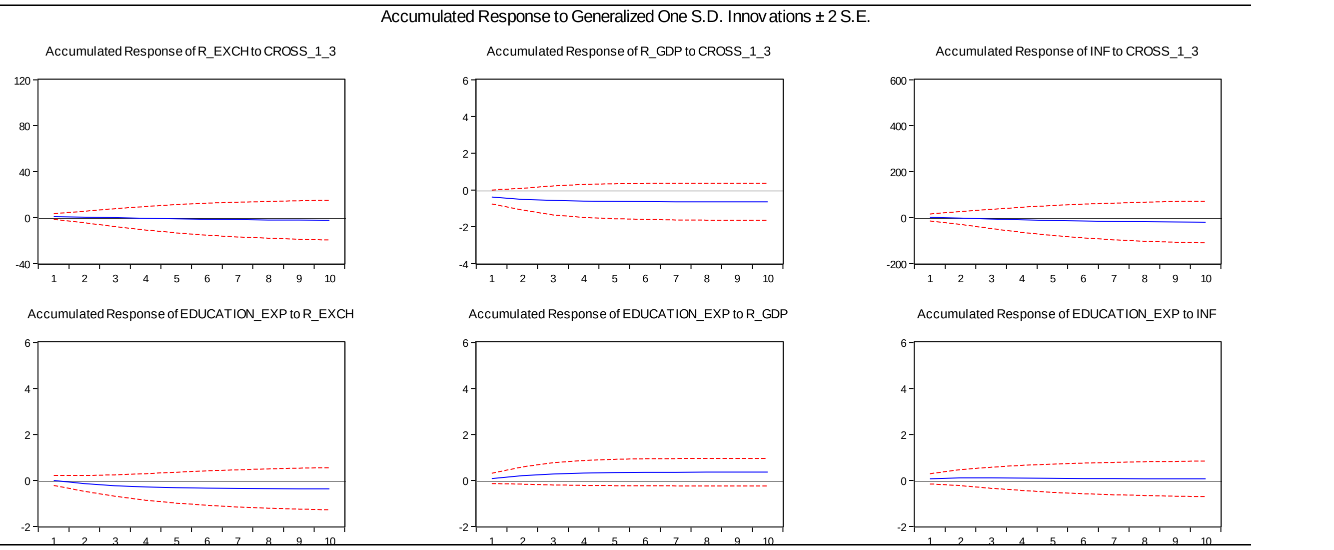
The results suggest that oil rent volatility exercises a direct negative effect on Education_EXP, as a percentage of GDP, suggesting that when oil rent uncertainty increases this leads to lower Education_EXP (see PGIRFs of Appendix D.37). In addition, the uncertainty of oil rents leads to a decline in R_GDP. However, a positive shock to R_GDP leads to a higher Education_EXP, as a percentage of GDP. In fact, government in these countries reduce education expenditure in response to oil rent uncertainty; on the other hand, reduced economic growth would decrease education expenditures through the income effect.

Figure 7.37. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on education expenditure in non-Democratic countries

Direct effects



Indirect effects



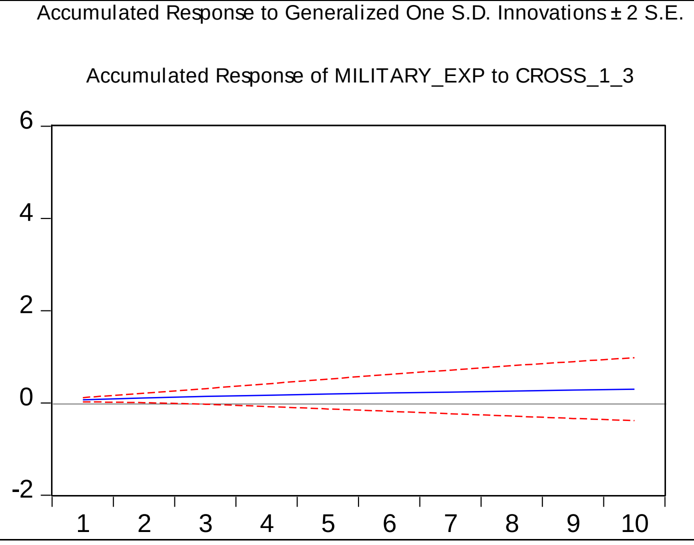
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut1dem0, EDUCATION_EXP= education expenditure

7.6.3.2 Cross_1_3 (OilrentsV_aut1dem0) and military expenditure

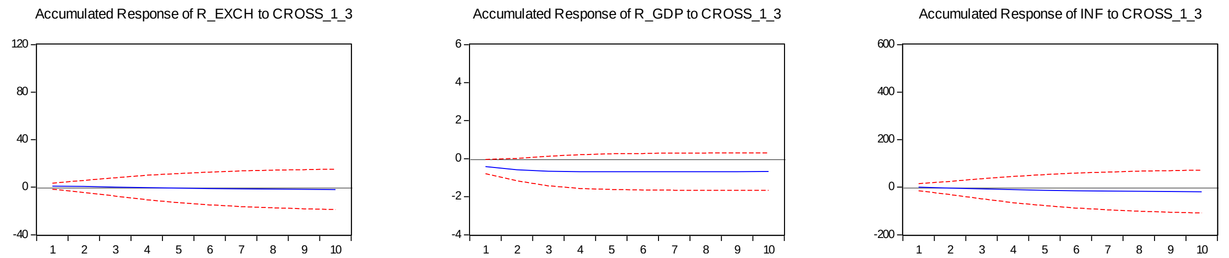
Reference to Fig. 7.38, indicates that oil rent volatility leads to an increase in Military_EXP, as a percentage of GDP, through the direct channel (see PGIRFs of Appendix D.38).

Figure 7.38. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on military expenditure in non-Democratic countries

Direct effects



Indirect effects



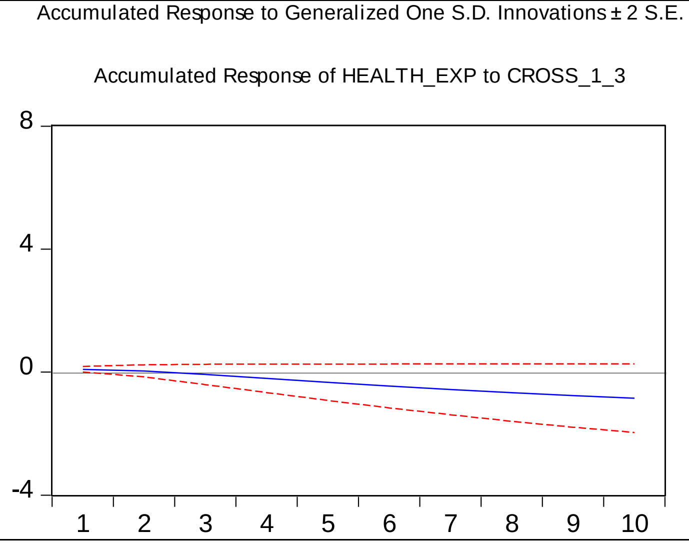
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut1dem0, MILITARY_EXP= military expenditure

7.6.3.3 Cross_1_3 (OilrentsV_aut1dem0) and health expenditure

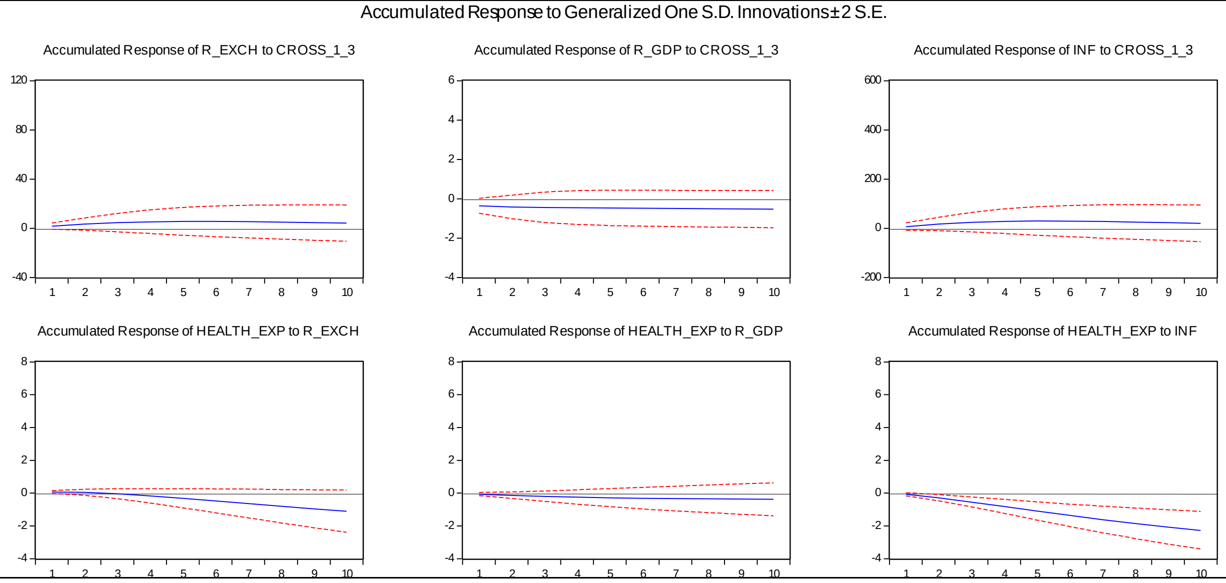
In non-democratic countries, an increase in oil rent volatility leads to a decline in the share of Health_EXP, as a percentage of GDP, through the direct channel; on the other hand, there is an increase in this variable through the indirect income channel (see PGIRFs of Appendix D.39). The reduction in Health_EXP via the direct channel is greater than the decline in GDP through the indirect channel. However, the share of Health_EXP, as a percentage of GDP, increases through the income channel due to reduced income and low-elasticity of health expenditure. The outcome of these two effects is a reduction in the share of Health_EXP, as a percentage of GDP.

Figure 7.39. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on health expenditure in Non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut1dem0, HEALTH_EXP= health expenditure

7.6.4 Cross_2_1 (OilV_aut1dem0xrreg) and disaggregated government spending

In this part, the multiplicative variable of xrreg is used and the degree of constraints on the executive is considered to evaluate the effect of oil volatility on disaggregated government spending in non-democratic countries.

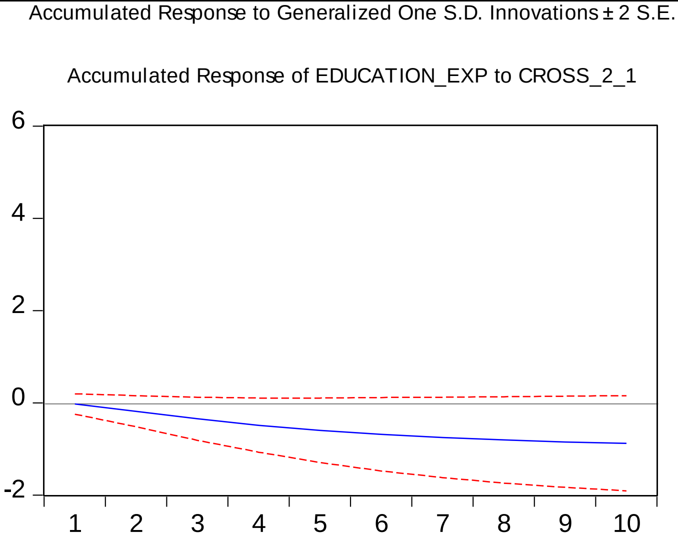
7.6.4.1 Cross_2_1 (OilV_aut1dem0xrreg) and education expenditure

Figure 7.40 indicates that oil price volatility exercises a direct negative effect on Education_EXP, as a percentage of GDP, in non-democratic countries (see PGIRFs of

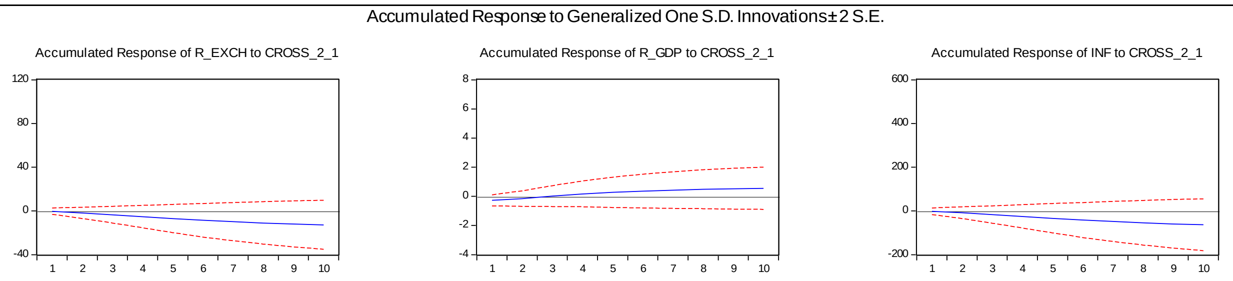
Appendix D.40). Therefore, there is a greater reduction in Education_EXP, as a percentage of GDP, in non-democratic countries, compared to the previous case. A positive oil price volatility shock in these countries leads to a decline in the share of Education_EXP, as a percentage of GDP, and this suggests that democratic attributes reduces the rate of such an effect.

Figure 7.40. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on education expenditure in Non-Democratic countries

Direct effects



Indirect effects



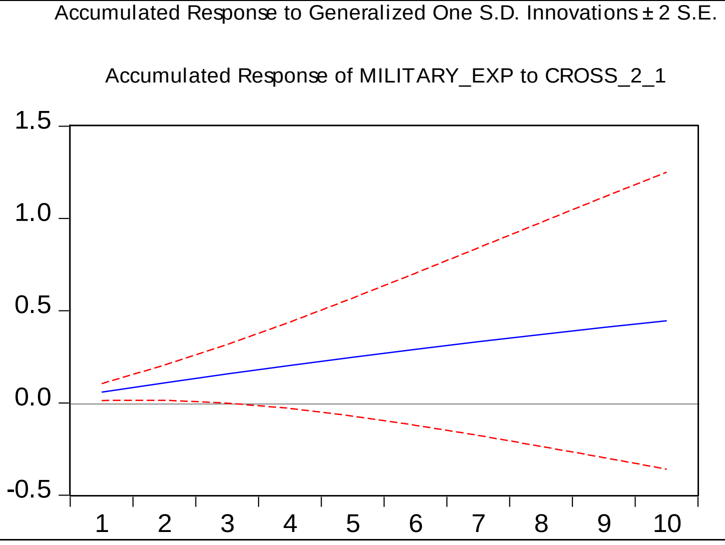
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut1dem0xrreg, EDUCATION_EXP= education spending

7.6.4.2 Cross_2_1 (OilV_aut1dem0xrreg) and military expenditure

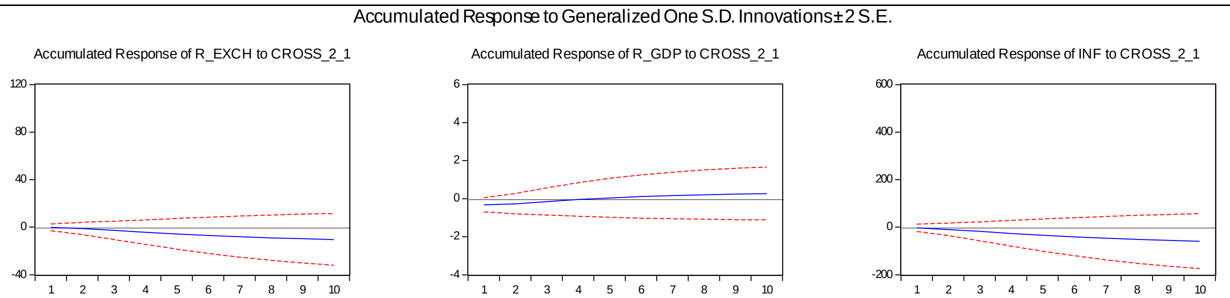
In non-democratic countries the inclusion of the xrreg variable indicates that Military_EXP, as a percentage of GDP, increases as a result of an oil price volatility shock (see PGIRFs of Appendix D.41). The rise in Military_EXP, in this instance, is greater than seen in the previous case.

Figure 7.41. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on military expenditure in Non-Democratic countries

Direct effects



Indirect effects



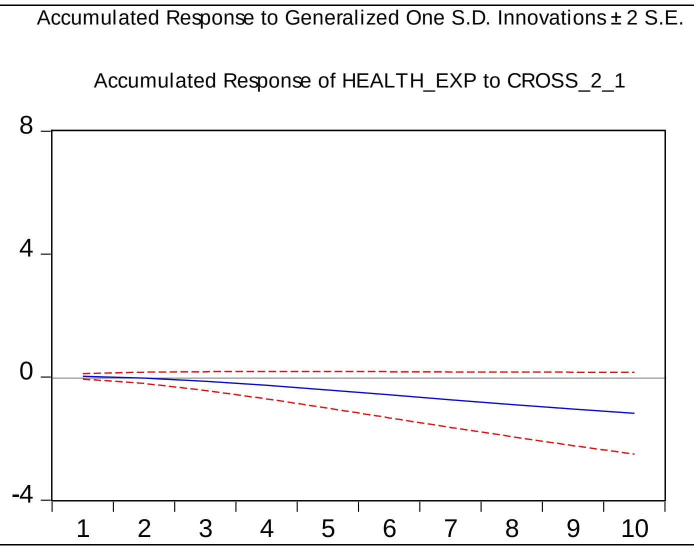
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut1dem0xrreg, MILITARY_EXP= military expenditure

7.6.4.3 Cross_2_1 (OilV_aut1dem0xrreg) and health expenditure

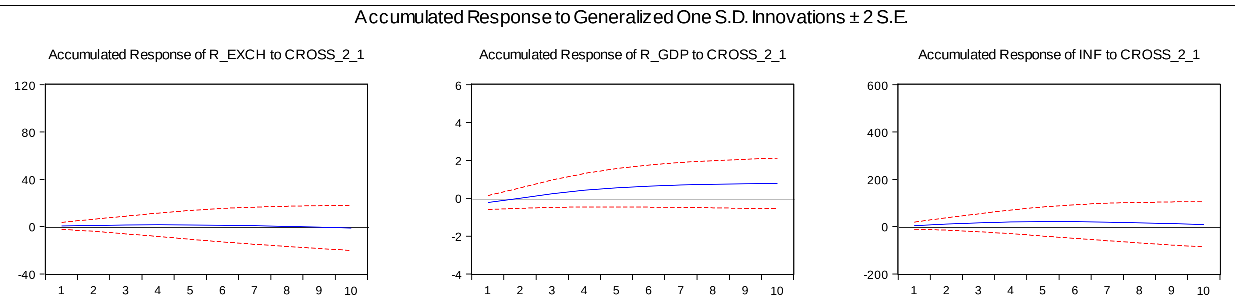
It can be seen that a positive oil price volatility shock leads to a reduction in Health_EXP; this reduction rate is equal to that previously seen in non-democratic countries (see PGIRFs of Appendix D.42). Therefore, democratic attributes had no effect on the health expenditure response in these countries.

Figure 7.42. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on health expenditure in Non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= OilV_aut1dem0xrreg, HEALTH_EXP= health expenditure

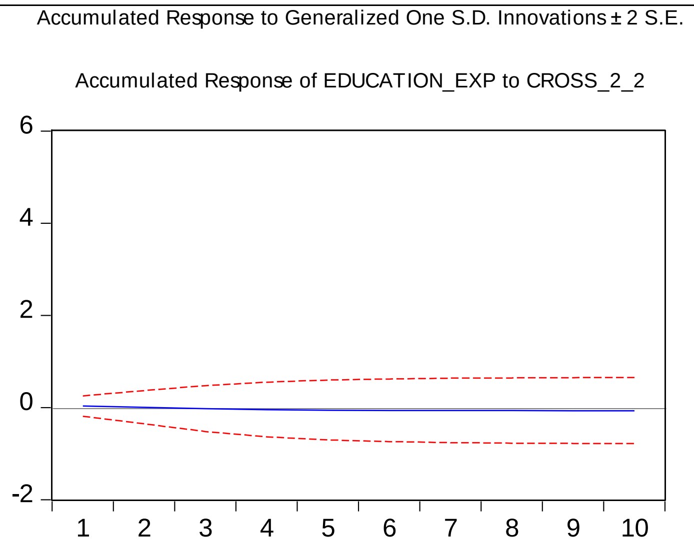
7.6.5 Cross_2_2 (OilrevenueV_aut1dem0xrreg) and disaggregated government spending

7.6.5.1 Cross_2_2 (OilrevenueV_aut1dem0xrreg) and education expenditure

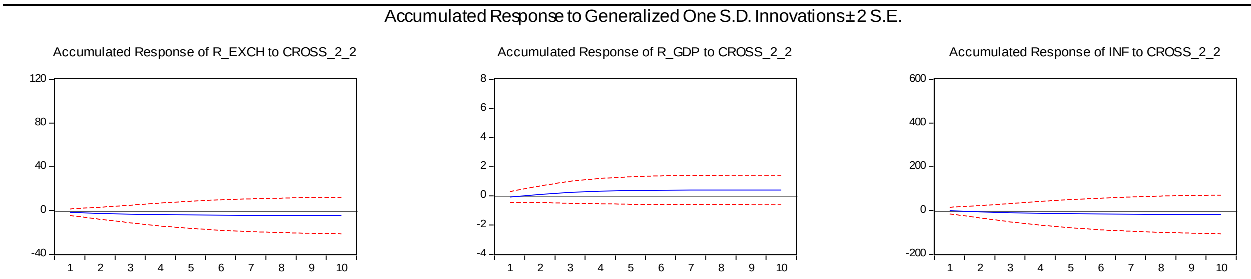
The findings from Fig. 7.43 illustrate that oil revenue volatility does not exert any significant direct or indirect effect on Education_EXP, as a percentage of GDP, by controlling the extent of democratic attributes in non-democratic countries; this result is in line with previous results (see PGIRFs of Appendix D.43).

Figure 7.43. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on education expenditure in Non-Democratic countries

Direct effects



Indirect effects



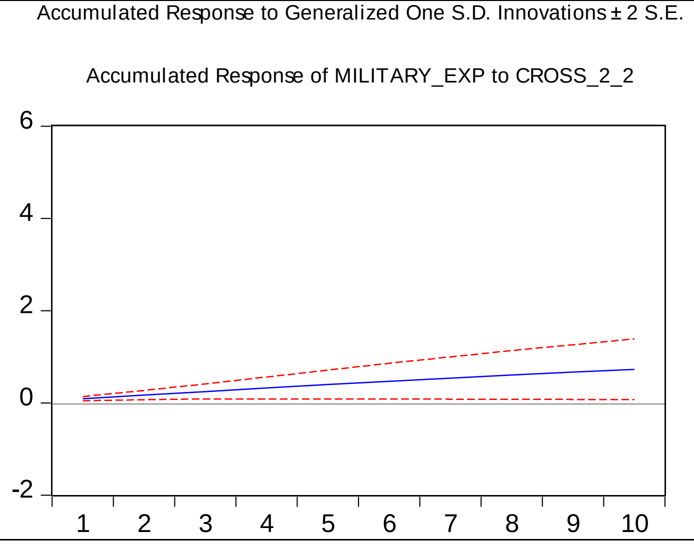
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut1dem0xrreg, EDUCATION_EXP= education expenditure

7.6.5.2 Cross_2_2 (OilrevenueV_aut1dem0xrreg) and military expenditure

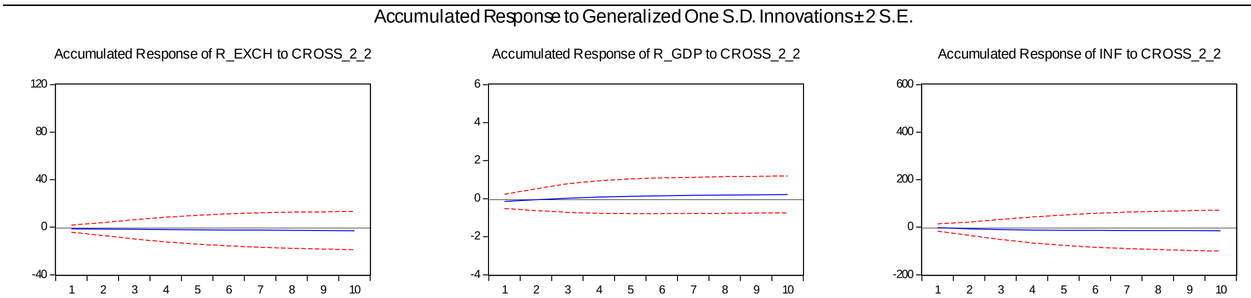
There is also no appreciable change in the results by adding the xrreg variable to the model of Military_EXP, as a percentage of GDP, in non-democratic countries (see PGIRFs of Appendix D.44). As seen previously, an increase in oil revenue volatility in these countries led to an increase in Military_EXP, as a percentage of GDP.

Figure 7.44. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on military expenditure in Democratic countries

Direct effects



Indirect effects



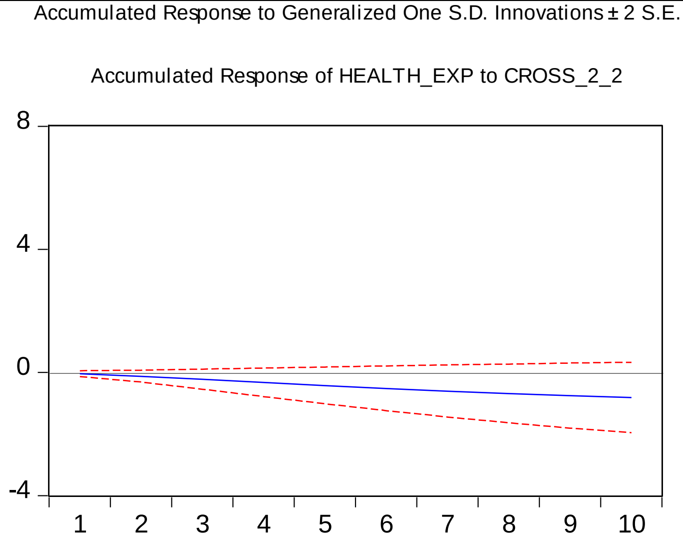
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut1dem0xrreg, MILITARY_EXP= military expenditure

7.6.5.3 Cross_2_2 (OilrevenueV_aut0dem1xrreg) and health expenditure

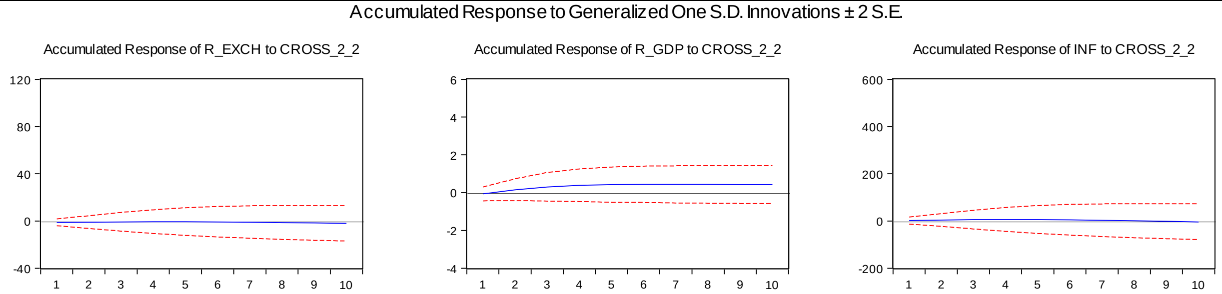
Similar results are obtained for Health_EXP by controlling for democratic attributes in non-democratic countries. In this case, an oil revenue volatility shock leads to a reduction in Health_EXP, as a percentage of GDP, but only in the direct channel (see PGIRFs of Appendix D.45).

Figure 7.45. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on health expenditure in Non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= OilrevenueV_aut1dem0xrreg, HEALTH_EXP= health expenditure

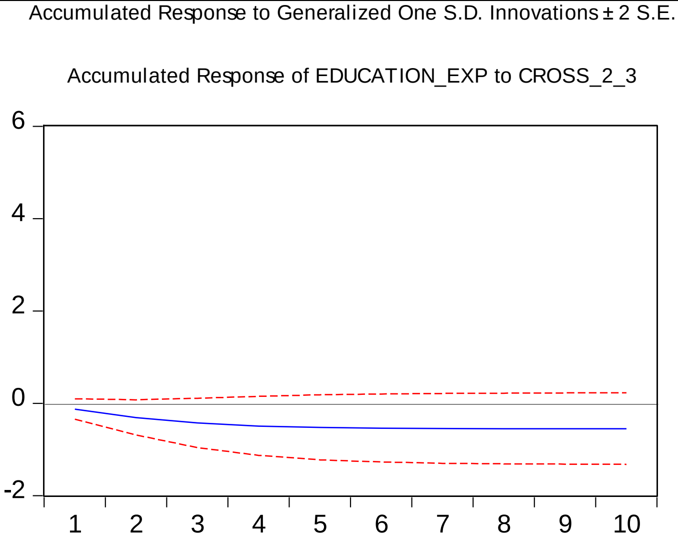
7.6.6 Cross_2_3 (OilrentsV_aut0dem1xrreg) and disaggregated government spending

7.6.6.1 Cross_2_3 (OilrentsV_aut0dem1xrreg) and education expenditure

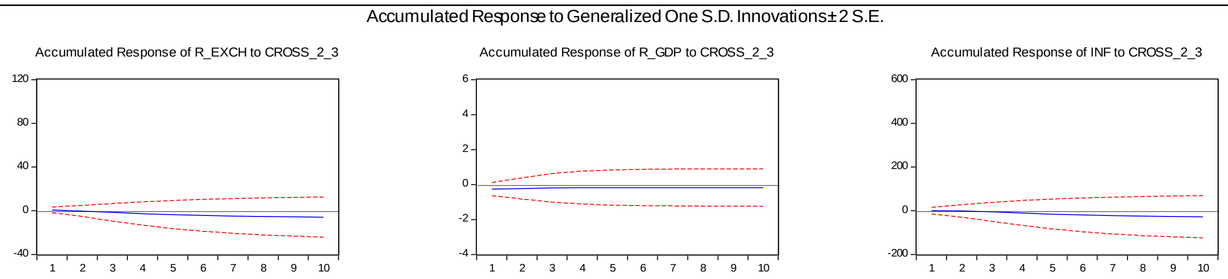
In terms of the oil rent volatility in non-democratic countries, the inclusion of the xrreg variable controls for the effect of the degree of democratisation and finds that, in relation to the direct effect there is a lower reduction in Education_EXP, as a percentage of GDP. (see PGIRFs of Appendix D.46). There is no evidence of any effect in the indirect channels. Therefore, the presence of democratic attributes in these countries reduces the effect of oil rent volatility on education expenditures.

Figure 7.46. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on education expenditure in Non-Democratic countries

Direct effects



Indirect effects



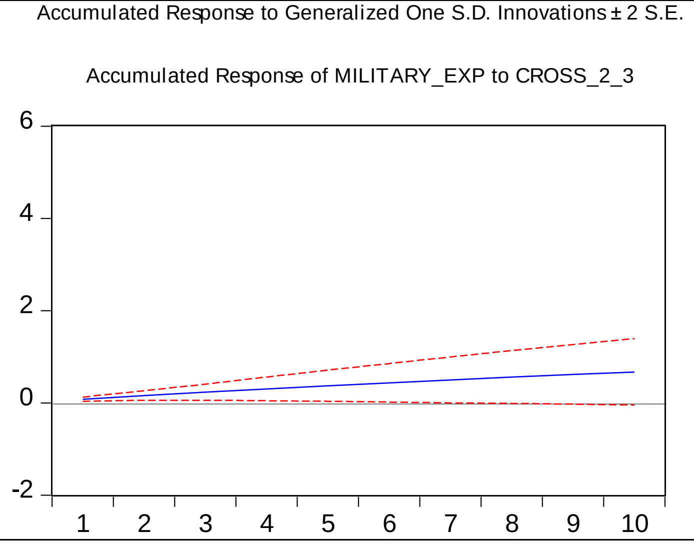
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut1dem0xrreg, EDUCATION_EXP= education expenditure

7.6.6.2 Cross_2_3 (OilrentsV_aut1dem0xrreg) and military expenditure

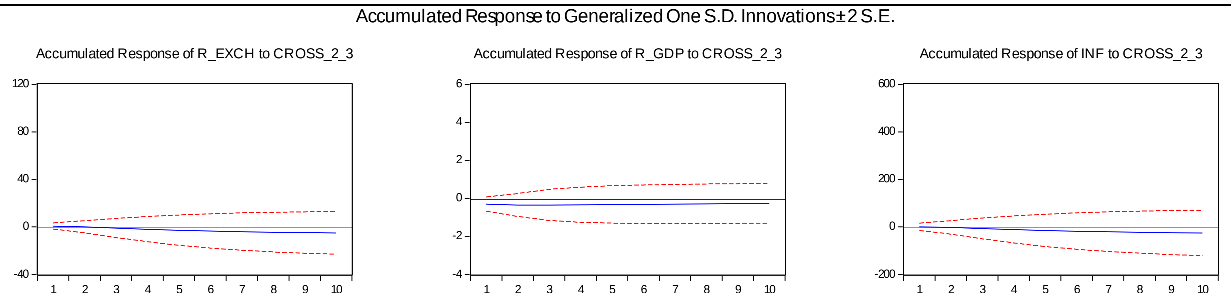
In non-democratic countries, with the inclusion of the xrreg variable, an increase in oil rent volatility leads to an increase in Military_EXP, as a percentage of GDP. The results are similar to those seen previously (see PGIRFs of Appendix D.47).

Figure 7.47. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on military expenditure in Non-Democratic countries

Direct effects



Indirect effects



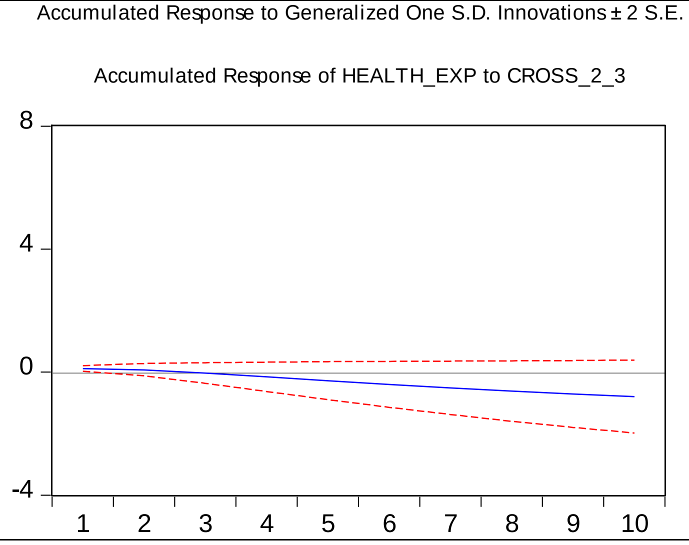
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut0dem1xrreg, MILITARY_EXP= military expenditure

7.6.6.3 Cross_2_3 (OilrentsV_aut1dem0xrreg) and health expenditure

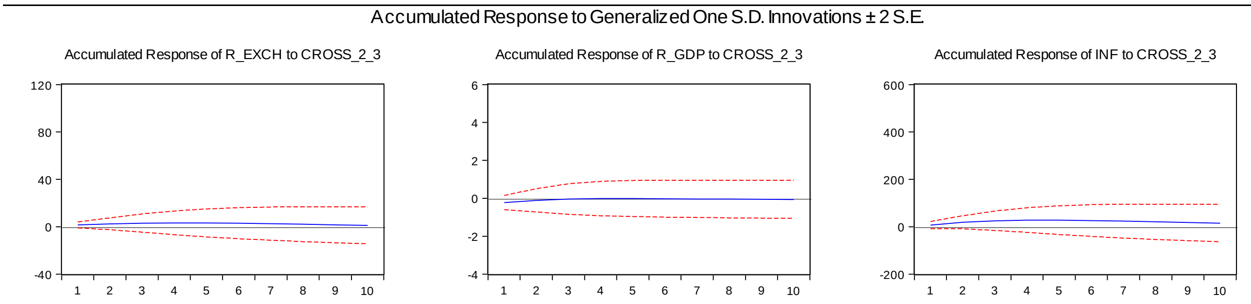
When using the xrreg variable to measure democratic attributes in terms of health spending in non-democratic countries, we see that oil rent volatility reduces Health_EXP, as a percentage of GDP. (see PGIRFs of Appendix D.48). Moreover, the reduction rate in the share of Health_EXP, as a percentage of GDP, is lower with increasing oil rent volatility. Contrary to the previous case, the indirect income and exchange rate indirect channels are not significant.

Figure 7.48. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on health expenditure in Non-Democratic countries

Direct effects



Indirect effects



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= OilrentsV_aut1dem0xrreg, HEALTH_EXP= health expenditure

7.7 Overall comparison between democratic/ non- democratic countries

This section compares the results of the effect of oil volatility on the government spending components selected for the two groups of countries under study.

The results obtained from the effects of oil volatility on government spending components in democratic countries indicates that an increase in oil price volatility leads to a rise in education and health expenditures, as a percentage of GDP, in these countries; military expenditure, as a percentage of GDP, is unaffected. Oil revenue and oil rent volatility have a positive effect only on the health expenditure, as a percentage of GDP, in these countries. There is no change in the results when the degree of democracy is controlled in these countries.

However, results for non-democratic countries show that an increase in oil price and oil rent volatility leads to a reduction in education expenditure, as a percentage of GDP with an increase in oil price, oil revenue and oil rent volatility leading to a reduction in health expenditure, as a percentage of GDP. Increases in oil price, oil revenue and oil rent volatility lead to an increase in military expenditure, as a percentage of GDP. Also, by controlling for democratic attributes in non-democratic countries, the effect of oil volatility leads to a reduction in education and health expenditure, as a percentage of GDP, with no significance being seen in the indirect channels of income and exchange rates. Additionally, there was no significant change in military expenditure as a percentage of GDP.

It is evident that, in relation to oil volatility, there is a difference of emphasis between the two groups of democratic and non-democratic countries, with the former displaying a lack of response to military expenditures, but a positive response to health and education expenditures. However, the results are reversed in non-democratic countries. In relation to oil volatility, the share of military expenditures is increasing and spending on health and education is reduced. It is clear that the difference in the strength of institutional development has caused varying reactions to oil volatility in the composition of government spending. In democratic institutions, with the result of oil volatility has a negative effect on the economy, but the government actually maintains educational and health expenditure and reduces or maintains stability in military spending. The opposite is true in non-democratic countries. As Brown and Hunter (1999, p.779) state, "Democracy can matter in systematic and substantial ways."

Brown and Hunter (1999) explain that in a democratic regime, the population's demands are more prominent and therefore greater resources are allocated to social programs. Whilst, in an authoritarian regime, economic constraints have the impact of reducing government revenue and the tendency is to reduce social spending, and this is done at a faster than in democratic regimes. Habibi (1994) shows that political liberties affect both the spending of public and structure of public budgets. In democratic countries, the tendency is to spend on more social programs and less on military expenditures. One explanation is that, in non-democratic societies, the army has more power and wields it through either direct control of the political system or close contact with legislators and this provides the opportunity to use their influence to increase military spending. In democratic countries, citizens are more concerned with social spending than any commitment to a military budget.

Lane and Tornell (1996) express that in the absence of well-defined property rights, the abundance of natural resources leads to the emergence of rent behaviour. Equally, in an

autocratic environment weak political and institutional structures allow powerful entities to control fiscal distribution which is exacerbated by the voracity effect resulting in a negative influence on economic growth. The causal relationship is a high, almost unaffordable, level of income distribution which reduces investment returns and the economy deteriorates described by many as the resource curse. Furthermore, Wintrobe (2000) explains that in a dictatorship more so than in a democracy, there is a tendency to redistribute income, wealth, and resource for the benefit of the ruling class. This entails the use of military power and the restriction of freedom of speech, labor unions, community associations and opposition parties. Plumper and Martin (2003) illustrate that as autocracy increases, more resources are transferred to the political elite whereas, as democracy increases, public goods supply increases and the share of rental transfers are reduced. With the rise of democracy, a more symmetric fiscal distribution mechanism is introduced with a greater emphasis on social spending to improve national welfare.
Avelino et al. (2005) and Brown and Hunter (2004) find that democracy has a strong and positive correlation with social spending and particularly in areas such as health and education together with a greater emphasis on investment in human capital. They opine that one of the possible reasons is the relationship between competitive elections and the efforts of politicians to win votes which requires support from people who benefit from these forms of expenditure.

7.8 Conclusion

The purpose of this chapter was to investigate the direct and indirect effect of oil volatility on the aggregated and disaggregated government expenditure on education, the military and health, in a group of democratic and non-democratic countries. The sample period runs between 1983 and 2015 and a panel Vector Auto-Regressive (PVAR) model, along with panel impulse response functions, are employed. This study evaluated the effect of oil volatility in both groups with the intention of establishing whether the influences that form democracies, namely, strong institutions, the rule of law, property rights and the role of the population in selecting leaders created a different dynamic in the distribution of government expenditure.

The results of this empirical analysis show that an increase in oil volatility leads to an increase in the share of government expenditure, as a percentage of GDP. However, the scale of the impact varies between two groups of countries. Additionally, as the democratic features and traits develop in non-democratic countries, the response to oil volatility shocks in relation to government expenditure, as a percentage of GDP is more likely to react in a similar way to that seen in democratic nations.

Despite the fact that in both countries the share of total government expenditure, as a percentage of GDP, increases, this study observed that a completely different behaviour pattern occurs in response to oil volatility when separated into the main components of government expenditure. Oil volatility did not have any significant effect on the share of military expenditure, as a percentage of GDP, in democratic countries, whilst in non-democratic states it leads to an increase. Even when the degree of democratic traits in non-democratic countries is controlled, there is no significant change in the response to military expenditure.

On the other hand, in non-democratic countries, the response to oil volatility and its negative effect on the economy (the potential mechanisms involved are described in previous chapters), is to reduce their expenditure on education and health, which does not occur democratic countries. When the effect of any democratic traits are included in the estimator the reduction of education and health expenditures in non-democracies in response to oil volatility is lessened.

Thus, there is a difference between non-democratic and democratic countries in increasing the share of government expenditure, as a percentage of GDP. In non-democratic countries, rising military expenditure and decreasing education and health expenditures are occurring with increasing oil volatility, while in democratic countries the opposite is established. Therefore, the results show that governments are more committed to education and health expenditure in democratic countries than non-democratic countries, and oil volatility shocks do not lead to a sacrifice of education and health expenditure. Moreover, in the democratic countries, the government reduces military expenditure as a result of increasing oil volatility to provide for the financing of education and health, whilst in non-democracies the opposite occurs with a reduction of education and health expenditures to finance military expenditure. These results are consistent with the findings of Stasavage (2005), Nelson (2007) and Balamatsias (2018), who claim that increasing democracy leads to an increase in education and health expenditures. Dunne et al. (2003) find that democracy is accompanied by a reduction in military expenditure. Additionally, Farzanegan (2011) indicates that it is only military expenditure of the Iranian government that consistently reacts to oil shocks whereas there is no significant effect on non-military expenditure. In addition, by examining 125 countries, Kotera et al. (2017) suggest that democratisation is accompanied by rising health expenditure and the lowering of military expenditure, and changes the government’s behavior.

The results in this study conform to literature. The organisation and institutional structures of the economies of the natural resource’s exporters are influential in determining the pattern of government expenditure. In particular, the oil exporters are particularly influenced in relation to their economic decisions, and how oil resources are spent, and, most importantly, their reaction to oil volatility. The results of this chapter show that as the index of democracy increases, the government's response to oil volatility is to maintain education and health expenditure, as a public good, and wherever democracy is imperiled the opposite is true and military expenditure is maintained or increases, which is in the interest of certain groups. Therefore, in relation to the pattern of government expenditures in oil exporting countries, the quality of political institutions is important.

Chapter 8- Conclusion

8.1 Summary and contribution of the thesis

After the oil crises of the 1970s, oil price rises, falls and fluctuations have become a major source of debate because of the economic, geopolitical and geosocial impact caused by these movements. World crude oil markets have experienced numerous fluctuations and instabilities, and it is recognised that oil has become one of the most influential commodities with a strategic importance to the global economy. Oil market dynamics and evolution can explain the fluctuations that have occurred in world economies, as these lead to both economic and non-economic crises. Therefore, it is not surprising that the whole subject of oil supply and demand, pricing and volatility has become an important area of academic research with a significant volume of literature extant on the subject. Extensive studies have been developed where, some studies (Hamilton 1983; Mork 1989; and Kilian and Vigfusson 2017) have examined the effects of oil prices on total supply, and others (Edelstein and Kilian 2009; and Bokan et al. 2018) have evaluated the effects of oil prices on consumption and. Other studies, such as Baumeister and Kilian (2016), have focused on the oil price effects on investment. Lastly, there are studies (Farzanegan 2011; Dizaji 2014; Adedokun 2018; Abdel-Latifi 2018) that focus on the impact of oil prices on government expenditures.

Although there is comprehensive theoretical and empirical literature relating to the level of the effects of oil price, oil revenue and oil rent on the macroeconomics of countries (importer and exporter), the economic effects of their volatilities have been less widely considered. De V. Cavalcanti et al. (2015) claim that it is the volatility of natural resources that are the key component in and not the actual price and this is particularly true of oil. This element of the dynamics of the market is more important than the actual price of oil. This implies that research focussing on volatility could have important implications for policy making and economic research.

Elder and Serletis (2010) and Jo (2014) contribute to this genre by assessing the effects of oil volatility on macroeconomic indicators, claiming that the most important effects of oil volatility on the economy are through the creation of information uncertainty, change in expectations, rising inflation, and lower investment, which impacts industrial output.

Oil volatility threatens the economic and geopolitical conditionality of both oil importing and exporting nations. Hence, oil volatility creates significant challenges for policymakers, in particular governments, when they are making policies or plans in oil-dependent countries; such challenges will be more apparent in countries where their governments rely on oil revenues to finance the public budget. The uncertainty created by oil volatility is particularly acute in these states.

This study contributes to the debate on oil volatility by identifying and generating an understanding of the effects of oil volatility on government spending, as a percentage of GDP, in oil exporting countries. In order to better understand the effects of oil volatility, the process of research and data sampling are divided into several evaluative segments. Firstly, the countries were classified into two groups of OPEC and non-OPEC countries. Secondly, government spending was divided into three main components, namely educational, military and health expenditures, in order to analyses the different potential effects of oil volatilities on government spending across different components. Thirdly, another classification was created based on the institutional quality of the sample countries (measured by the democracy index). Therefore, the research not only studied the effect of oil volatility on the government's spending components and the fiscal response observed but, also the effects of oil volatility on the countries under investigation were analysed, using panel VAR methods, to consider whether responses were different depending on institutional quality. These countries could be members of the OPEC oil cartel (largely undemocratic) or with varying levels of democracy (Venezuela and Ecuador). According to the researcher's knowledge, there is no comprehensive study on the effects of oil price volatility, oil revenue volatility and oil rent volatility on government spending in oil exporting countries, so this thesis adds new empirical evidences and contributes to literature on oil volatility's effects on the economies of oil exporting countries.

8.2 Main conclusion

This section summarises the results of the three oil volatility indicators analysed in OPEC and non-OPEC countries, together with those that evaluated fiscal policy responses in democratic and non-democratic countries.

8.2.1 Oil volatility and aggregated government expenditure

In the empirical models estimated in Chapter 5, the findings indicate that oil price volatility does not exert any significant effect on aggregated government spending (% of

GDP) in OPEC countries while, in non-OPEC countries, with rising oil price volatility, total government spending (% of GDP) has been affected by direct and indirect channels and eventually increases. However, the volatility of oil revenues has a different effect on aggregated government spending. The higher oil revenue volatility does not have a significant impact in non-OPEC countries, whereas in OPEC countries, there is a decline in economic growth and inflation, and in particular, increased government expenditure as a percentage of GDP. Oil rents volatility impacts both groups of countries; however, the channel of influence is different. In OPEC countries, oil rent volatility exercises both direct and indirect impact on government expenditure via the exchange rate and inflation channel, while in non-OPEC countries, oil rent volatility affects government expenditure directly and only indirectly on government expenditure through the GDP channel.

The observed differences in the response of the two groups of countries to the volatility indicators can be explained as follows. OPEC countries are sensitive to the influence of the oil market in their economy, not the volatility of oil prices (in Chapter 5, one of the reasons is their membership of the OPEC cartel) and when their oil revenue and oil rents fluctuate and their economies are exposed to risk and uncertainty, we observe the negative effects, including rising inflation, reduced economic growth and increasing exchange rates. In the non-OPEC countries, the position is different. The results show that oil price volatility is more important than revenue and oil rents volatility and the reason for this is the greater openness of their economies. Their economies do not react to the volatility of oil revenues, probably because of the anti-shock and discretionary mechanisms they have taken to prevent oil revenues from entering directly into their economies, and this minimises its impact providing a more secure economic environment. This aspect seems to have been neglected in OPEC countries who allow the direct entry of oil revenues which inevitably impacts on their economies, generally, and particularly their budgets.

It is also apparent that there is a difference in government response to uncertainty among the two country groups. According to the findings, the increase in the share of government spending (% of GDP) in response to oil volatility in OPEC countries is not discretionary policy arising from the government's authority but, the evidence of this research model, it is more of a passive action, resulting, not form government control but due to changes in economic indicators which force a fiscal policy to emerge. For example, rising exchange rates create inflationary pressure in a climate of lowering national income, reducing budget revenues, and increasing government expenditure. In contrast, in non-

OPEC countries, the positive response of the share of government's (% of GDP) to rising oil volatility is clear in that it comes directly from the government and as an active policy to reduce the negative economic effects of volatility.

8.2.2 Oil volatility and disaggregated government expenditure

Chapter 6 has examined the direct and indirect effect of oil volatility on disaggregated government expenditure, which consists of education, military and health expenditure in OPEC and non-OPEC countries.

The results of the second empirical analysis reveal no significance in the response of education expenditure to oil price volatility in both OPEC and non-OPEC countries. Also, increase in oil price volatility leads to a rise in their health and a reduction in military expenditure in OPEC countries. This is due to an absolute increase in the former and a decrease in the latter as a result of exogenous pressure. For example, an increase in the cost of military equipment as a result of increasing oil prices resulting in a refusal to buy or the political response of a refusal to sell (see chapter 6 pp.139 for detail). In non-OPEC countries, oil price volatility increases only their share of military spending, probably for the same reason. However, an increase in oil revenue volatility leads to a rise in military expenditure in OPEC countries since this is an endogenous effect, where an increase in sovereign cash flow allows military rentiers to lobby for a share in the receipts. However, oil revenue volatility has no effect in non-OPEC countries. This can be explained by the decline in economic growth which reduces GDP but the maintenance of the absolute value of military expenditure increases its proportion as a percentage of GDP. Similar to the results in Chapter 5, oil revenue volatility does not exert any effect on disaggregated government expenditure in non-OPEC countries. On the other hand, oil rent volatility has a similar effect with an increase in health and military expenditure as a percentage of GDP, primarily due to the maintenance of real value against a background of a declining economy but oil rent volatility does not have significant effect of education expenditure. Therefore, the government in these countries responds to oil rent volatility, by no education expenditure whilst maintaining that of the health and military, which ultimately increases the government expenditure but reduces the opportunity to increase absorptive capacity. This result is consistent with evidence in literature; Gylfason (2001) found that countries with abundant natural resources ignore human capital development and do not recognise the need for a sustainable educational policy which suffers from a diminishing allocation. However, there is evidence suggesting that oil-exporting countries allocate more of their revenue to military expenditure (Gary and Karl 2003), and it can be inferred that the government protects the interests of military groups at the expense of a reduction in education expenditure.

8.2.3 Oil volatility, the quality of political institutions, and government spending

The constituent elements of institutions in an oil economy undoubtedly affects the distribution and expenditure of oil revenues. In this regard, Chapter 7 of the thesis examines the role of institutional quality in influencing the oil volatility on government expenditure. Therefore, countries were divided into two categories of democratic and non-democratic states and the analysis was conducted by utilising the PVAR model. In the first section, the results showed that in democratic countries, with increasing oil volatility, and referencing the previous results and mechanisms described earlier, the share of government spending (% of GDP) increases. In non-democratic countries, however, the response of government to oil volatility fluctuates with several positive and then negative periods in the time frame being observed. However, as the degree of democratic attributes increase in non-democratic countries, total government expenditure responds in a similar manner to democracies. This difference in response between the two countries can be attributed to the varying nature of institutional quality. As the literature shows, poor institutions and rents are associated with a weakening of economic policies, financial instability, the voracity effect phenomenon, and the over-sensitivity of fiscal strategies financial policies which are all reflected in oil revenue shocks.

In the second part of the study, it was examined whether the quality of institutional input affected the reaction of the selected components of government expenditures to oil volatility. The empirical results show that in the democratic countries, an increase in oil volatility is accompanied by a rise in the share of education and health expenditure as a percentage of GDP, while the share of military expenditure does not change.

In contrast, in non-democratic countries, oil volatility leads to a reduction in the share of education and health expenditure as a percentage of GDP and an increase in the share of military expenditure, a result that is quite the opposite of democratic countries. In addition, by controlling for the degree of democratic attributes in these countries, the percentage of reduced health and education expenditure in response to oil shocks slows, although rising military expenditure does not show any significant sensitivity to this control. Therefore, there are two very different attributes of government spending components in response to rising oil volatility in these countries and clearly, the reason for this is the difference in the quality of institutions (democracy). Democratic countries maintain health and education expenditure despite the effect of oil volatility while, non-democratic countries sacrifice education and health expenditure in favour of military expenditure. The results are consistent with economic literature which show that in non-democratic countries where political power, the distributor of economic wealth, controls particular groups with militarism dominating resulting in the priority being given to military expenditure. The situation deteriorates further when oil rents are allocated directly to the government and poor administrative capacity mismanages spending and allocation. As the voracity effect emerges, specific groups require a larger share of public resources regardless of the effect of oil volatility, when institutions of a rentier and autonomous political structure are in control of the economy. Governments are more likely to meet the demands of minority groups who wield political and military power; as a result, social spending and investment in human capital are not regarded as a priority. Even with the volatility created in the oil market these governments maintain and sometimes increase military expenditure. In contrast, in a democratic political structure the quality of institutions is superior and the obligations of the government towards the population stronger therefore society’s needs are prioritised and the share of public goods and social spending in the state budget increases. Therefore, the quality of institutions is not only important in responding to oil volatility in relation to government spending, but also in determining which components receive priority.

8.3 Limitation of research

Throughout the conclusions drawn from the empirical chapters (5-7), some limitations cannot be overlooked.

The applied statistics and data are the main limitations of the economic research. The major challenge in economic studies is a reliable data source with sufficient information for econometric modelling. This research faced some issues relating to the use of different databases drawn from an incoherent statistical system where data classification made the research process difficult. The problems that arose included data incompatibility, measurement errors and, the extraction of information from a variety of data sources.

Another econometric analysis limitation in this thesis is the lack of non-linear panel data methodology, such as regime changing methods in PVAR models, which are in line with linear estimators and technics in applied econometrics. Linear estimators were used to estimate the relationship between the main variables in this research; as a result, it was not possible to test and investigate the existence of potential non-linear relationships. It should be recognized that oil price uncertainty in OPEC countries may not be linear which may create difficulties in interpreting the results.

The thesis utilizes annual data between 1983 and 2015. This limits the number of observations which would have been available with a higher frequency of data points. For example, if adequate quarterly data had been available a greater depth of analysis would have been possible.

8.4 Policy implication for the OPEC and non-OPEC countries

There are a number of policy implications that can be derived from this research. Oil market price uncertainties do not have a significant effect in OPEC countries, however, oil revenue volatilities can be particularly destructive, and implies that these countries do not have an adequate defence mechanism against fluctuations experienced in oil export revenues. The establishment of national wealth funds, and the accumulation of oil revenues within them provides an income obtained from the fund's activities which can mitigate the problems caused by oil uncertainty in oil exporting countries. In the event that countries are not able to employ some of these mechanisms they can control their uncertainty risk or oil revenue volatilities by selling their oil under future and forward contracts, together with the use of other financial tools available in the oil market. Therefore, an element of the destructive effects of oil revenue volatilities on the budget and economic activities can be removed. Furthermore, another way for governments to confront oil revenue volatility is to plan for a degree of volatility in oil revenues and to adjust expenditures and budgets in such a way as to cater for such eventualities to mitigate for the effect of shocks to their revenue sources. Another solution is obligating the government to spend a finite and fixed amount of their oil revenues on future budget planning regardless current oil revenue surpluses and predicting oil revenues based on the moving average of the price and exports rates in previous periods.

In both OPEC and non-OPEC countries, we have seen the impact that oil rent volatility has had on government spending and on the economic indicators of these countries. In addition to potential solutions already discussed, there are some other solutions. These include opening economies to FDI inflows to develop additional investments and a technology transfers, particularly for the OPEC developing countries, such a move could assist in the development of downstream oil industries. Some structural changes and improvements could be introduced to include advances in more sophisticated oil derivatives with higher added value, expansion of an oil industry value chain, deregulation, increasing transparency, and the removal of governmental and unnatural monopolies. All can be used to reduce the destructive effects of oil rent volatilities.

The destructive effects of oil volatility can be mitigated by improvement in the quality of institutions and the expansion of the degree of democracy in both groups of countries. Governments in democracies are more likely to deal constructively with oil turmoil in order to reduce the destructive effects of turbulence in the domestic economy. Furthermore, the more democracy there is in the face of oil volatility results in governments being more committed to maintaining spending on education and health, and this is often achieved at the expense of a reduction in military expenditure. On the contrary, non-democratic states reduce education and health expenditures to finance military spending. Acemoglu et al. (2010) find that institutions have attributes that are determinants in the motivation of economic actors, which in turn influences income distribution and economic performance. Mehlum et al. (2006) also consider the quality of institutions, as a factor that affects the resource curse as a result of natural resources pushing aggregate income down, when institutions are orientated towards political power brokers and rentier elites. Therefore, efforts to improve the quality of institutions and democracy, as confirmed by the results of this thesis, help to reduce the destructive effects of oil volatility, especially oil revenue volatility. The empirical findings showed that oil revenue volatility has no effect on the domestic economy of democratic countries, indicating that the democratic institutions of these countries use some mechanisms to prevent a direct destructive effect on the budget and economy.

Additionally, in OPEC countries the results indicate that education and health expenditures might be reduced, and military spending maintained when responding to oil volatility; this has a greater degree of negativity when considering the welfare of ordinary people. Hence, if the quality of institutions and democracy improves in these countries, then there will be an improvement in the accountability and transparency of the decision makers within powerful institutions that determine social provisions. This will reduce the power of specific pressure groups and improve the budgetary expenditure behaviour of governments that spend the oil wealth thus creating a more beneficial environment for the population at large.

8.5 Recommendation for future research

As addressed in the various chapters, there have arisen issues that could provide direction for future research.

Non-linear econometric techniques, such as Markov-switching and Threshold methods and the Panel Smooth Transition Regression (PSTR) model, can be used in further studies. In this regard, it would be possible to estimate potential and possible non-linear relationships.

As the present research has used the PVAR method to model data, the research analyses were based on the dynamics between the variables, and, in principle, the short-term relations between them. Thus, future studies can estimate the relations between variables using panel data cointegration, such as Panel VECM to obtain long-term equilibrium relationships. Moreover, the Global VAR (GVAR) modelling can be used to consider all of the countries participating in the oil market, in order to achieve new perspectives in the experimental literature.

Further research in the field should incorporate the origin of oil price shocks and oil volatilities; that is, whether the volatility shock comes from the supply-side or the demand-side. This analysis could be extended to analysing the volatility of oil demand and oil supply shocks and to a micro-analysis at industry level. The effects of oil volatility on tax revenues and other governmental revenues can be evaluated in future studies. The response of governments to tax legislation and public budget financing methods (such as releasing bonds) when faced with oil volatility can be examined and would be a new perspective in the theoretical and experimental literature of the oil countries' economy. Future studies can therefore consider modelling the sources of oil price volatility shocks. Subsequently, they can examine the effects of the different oil price volatility shocks on the behaviour of government spending in oil-exporting countries, which could lead to more appropriate policy recommendations to counter (neutralize) their effects.

This research studied oil-exporting countries. Clearly, the case of oil-importing countries can also be of interest to researchers. Those oil importers that do not have oil revenue and oil rent, can be examined to study the effects of oil price volatility on their economy through a variety of channels, such as increasing investments risk, inflation expectations and or cost-push inflation, or the importance of their strategic oil reserves, as these countries consider oil as a production input or intermediary commodity. In addition, the governmental budget of these countries is financed by taxes due to a lack of oil wealth. Therefore, oil volatilities affect governmental spending through different mechanisms.

APPENDICES

Appendix A: Data and method description

Appendix A.1. GARCH output for Algeria

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.001156	0.0027	0.6781
Variance Equation			
C	0.0002	0.0001	0.0224
RESID(-1)^2	0.4369	0.1116	0.0001
GARCH(-1)	0.6270	0.0679	0.0000
Adjusted R-squared	-0.0003	S.D. dependent var	0.0898
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.2. GARCH output for Ecuador

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	0.0006	0.0035	0.8576
Variance Equation			
C	0.0007	0.0003	0.0113
RESID(-1)^2	0.4733	0.0614	0.0000
GARCH(-1)	0.5567	0.0546	0.0000
Adjusted R-squared	-0.0000	S.D. dependent var	0.0898
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.3. GARCH output for Iran

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	0.0005	0.0033	0.8576
Variance Equation			
C	0.0003	0.0001	0.0058
RESID(-1)^2	0.5122	0.0607	0.0000
GARCH(-1)	0.5950	0.0321	0.0000
Adjusted R-squared	-0.0000	S.D. dependent var	0.0964
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.4. GARCH output for Qatar

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	0.0022	0.0038	0.5592
Variance Equation			
C	0.0013	0.0002	0.0058
RESID(-1)^2	0.4119	0.0663	0.0000
GARCH(-1)	0.4877	0.0637	0.0000
Adjusted R-squared	-0.0005	S.D. dependent var	0.0905
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.5. GARCH output for Nigeria

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0024	0.0025	0.3271
Variance Equation			
C	0.0001	8.46E-05	0.0058
RESID(-1)^2	0.4658	0.0613	0.0000
GARCH(-1)	0.6337	0.0393	0.0000
Adjusted R-squared	-0.0010	S.D. dependent var	0.0899
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.6. GARCH output for Venezuela

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0016	0.0029	0.5859
Variance Equation			
C	7.30E-05	6.35E-05	0.0058
RESID(-1)^2	0.4216	0.0533	0.0000
GARCH(-1)	0.6968	0.0257	0.0000
Adjusted R-squared	-0.0000	S.D. dependent var	0.1098
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.7. GARCH output for Gabon

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0007	0.0026	0.7654
Variance Equation			
C	0.0001	9.41E-05	0.0058
RESID(-1)^2	0.4533	0.0618	0.0000
GARCH(-1)	0.6362	0.0409	0.0000
Adjusted R-squared	-0.0002	S.D. dependent var	0.0911
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.8. GARCH output for Mexico

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0015	0.0030	0.6105
Variance Equation			
C	0.0001	0.0001	0.2125
RESID(-1)^2	0.4097	0.0554	0.0000
GARCH(-1)	0.6710	0.0361	0.0000
Adjusted R-squared	-0.0005	S.D. dependent var	0.0934
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.9. GARCH output for Norway

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0018	0.0026	0.4952
Variance Equation			
C	0.0001	0.0001	0.1524
RESID(-1)^2	0.4342	0.0620	0.0000
GARCH(-1)	0.6408	0.0414	0.0000
Adjusted R-squared	-0.0006	S.D. dependent var	0.0907
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.10. GARCH output for United Kingdom

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0019	0.0026	0.4673
Variance Equation			
C	0.0001	0.0001	0.1605
RESID(-1)^2	0.4262	0.0604	0.0000
GARCH(-1)	0.6477	0.0411	0.0000
Adjusted R-squared	-0.0007	S.D. dependent var	0.0904
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.11. GARCH output for Brazil

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0025	0.0034	0.4585
Variance Equation			
C	8.88E-05	8.13E-05	0.2745
RESID(-1)^2	0.3690	0.0442	0.0000
GARCH(-1)	0.7231	0.0251	0.0000
Adjusted R-squared	-0.0004	S.D. dependent var	0.1089
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.12. GARCH output for Tunisia

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	0.0006	0.0038	0.8729
Variance Equation			
C	0.0011	0.0002	0.0000
RESID(-1)^2	0.5191	0.0652	0.0000
GARCH(-1)	0.4559	0.0553	0.0000
Adjusted R-squared	-0.0001	S.D. dependent var	0.0943
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.13. GARCH output for Egypt

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0010	0.0036	0.7674
Variance Equation			
C	0.0002	5.68E-05	0.0000
RESID(-1)^2	0.4449	0.0620	0.0000
GARCH(-1)	0.6362	0.0417	0.0000
Adjusted R-squared	-0.0002	S.D. dependent var	0.1015
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.14. GARCH output for Oman

Variable	Coefficient	Std. Error	Prob.
Mean equation			
C	-0.0004	0.0032	0.8988
Variance Equation			
C	0.0002	3.95E-05	0.0000
RESID(-1)^2	0.5340	0.0626	0.0000
GARCH(-1)	0.6011	0.0320	0.0000
Adjusted R-squared	-0.0000	S.D. dependent var	0.0903
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)			

Appendix A.15. Granger causality tests among the study's variables: Based on oil price volatility

Excluded	Dependent variable				
	OilV	GOV_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilV		5.495344*	4.495193*	8.389788*	5.760178*
GOV_EXP	4.104111*		4.656789*	7.5448145*	4.654351*
INF	6.845589*	5.002346*		3.933613*	7.016439*
R_EXCH	8.183548*	5.150569*	6.006723*		4.275530*
R_GDP	4.974086*	7.039503*	6.142879*	0.123401	
Non-OPEC Countries					
OilV		6.340138*	5.114466*	5.064775*	4.155092*
GOV_EXP	4.795829*		4.712743*	5.643895*	8.041694*
INF	7.402665*	5.035530*		4.218746*	1.086552
R_EXCH	4.208866*	7.057916*	8.976017*		5.023782*
R_GDP	5.327366*	5.005285*	4.633092*	8.589658*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.16. Granger causality tests among the study's variables: Based on oil revenue volatility

Excluded	Dependent variable				
	OilrevenueV	GOV_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrevenueV		7.145612*	5.373252*	4.163303*	4.820172*
GOV_EXP	5.104548*		4.656789*	7.5448145*	4.654351*
INF	8.852236*	6.558346*		4.002613*	6.944439*
R_EXCH	4.158548*	4.778799*	5.100723*		6.125530*
R_GDP	4.584086*	5.552147*	5.325879*	5.889401*	
Non-OPEC Countries					
OilrevenueV		4.564308*	4.055860*	6.234320*	5.019436*
GOV_EXP	4.795829*		4.712743*	5.643895*	8.041694*
INF	6.302665*	4.965530*		4.874746*	5.741552*
R_EXCH	6.159866*	7.100916*	5.076067*		4.604782*
R_GDP	8.630366*	7.441285*	5.821092*	5.699651*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.17. Granger causality tests among the study's variables: Based on oil rent volatility

Excluded	Dependent variable				
	OilrentsV	GOV_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrentsV		5.542427*	4.246483*	5.708882*	4.541207*
GOV_EXP	5.109881*		4.656789*	7.5448145*	4.654351*
INF	8.001589*	7.974346*		5.003613*	5.916439*
R_EXCH	5.251548*	4.985569*	5.986723*		8.125530*
R_GDP	4.974086*	7.039503*	6.142879*	0.123401	
Non-OPEC Countries					
OilrentsV		10.77082*	5.653424*	5.254443*	4.627738*
GOV_EXP	4.795829*		4.712743*	5.643895*	8.041694*
INF	7.014665*	5.035530*		4.218746*	1.086552
R_EXCH	5.020866*	8.417916*	4.041017*		4.092182*
R_GDP	4.100366*	7.995285*	6.855092*	4.580158*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.18. Granger causality tests among the study's variables: Based on oil price volatility

Excluded	Dependent variable				
	OilV	Education_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilV		8.517916*	5.239307	4.634095**	0.691203*
Education_EXP	4.104111*		5.509500*	6.087263**	7.146886*
INF	4.845589*	4.002346*		3.933613*	8.016439*
R_EXCH	7.183548*	4.150569*	7.006723		4.275530
R_GDP	6.974086*	6.039503*	4.142879*	5.123401	
Non-OPEC Countries					
OilV		4.124169*	4.087124*	5.103440*	5.121908*
Education_EXP	5.795829*		3.004573*	4.933938*	2.433112*
INF	4.402665*	4.035530*		4.108746*	5.086552*
R_EXCH	5.208866*	5.057916*	8.76017*		4.023782*
R_GDP	9.327366*	6.005285*	7.633092*	6.589658*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.19. Granger causality tests among the study's variables: Based on oil revenue volatility

Excluded	Dependent variable				
	OilrevenueV	Education_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrevenueV		4.000306*	5.567836*	3.9081080*	4.125714*
Education_EXP	5.857404*		4.320275*	4.0331451*	4.24903***
INF	5.252589*	5.004098*		3.9063737*	4.006508*
R_EXCH	4.977689*	5.144170*	4.864595*		3.180235*
R_GDP	6.797581*	7.039686*	6.219152*	4.017995*	
Non-OPEC Countries					
OilrevenueV		4.304165*	4.000132*	4.067852*	5.605968*
Education_EXP	4.294650*		3.968605*	4.806141*	4.5200699*
INF	4.155543*	4.136185*		4.110609*	4.0005110*
R_EXCH	5.004926*	4.132079*	7.801041*		5.08E-05*
R_GDP	6.259816*	7.815493*	5.759399*	5.541141*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.20. Granger causality tests among the study's variables: Based on oil rents volatility

Excluded	Dependent variable				
	OilrentsV	Education_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrentsV		5.211867*	5.262136*	4.768394*	4.418752*
Education_EXP	6.803759*		4.720097*	4.471211*	4.167734*
INF	6257228*	4.78E-05*		5.841609*	7.009911*
R_EXCH	6.771350*	3.322047*	3.002791*		6.278322*
R_GDP	7.038205*	4.066148*	5.002923*	5.051941*	
Non-OPEC Countries					
OilrentsV		4.780390*	5.774885*	5.227092*	3.102539*
Education_EXP	8.001034*		3.123544*	5.931561*	4.117122*
INF	7.117333*	4.573694*		4.866001*	4.004628*
R_EXCH	7.074774*	5.645255*	8.108524*		5.028930*
R_GDP	4.733303*	5.165233*	9.619344^{*9}	4.445387*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.21. Granger causality tests among the study's variables: Based on oil price volatility

Excluded	Dependent variable				
	OilV	Military_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilV		7.872192*	9.522073*	7.363950*	6.382416**
Military_EXP	4.611526*		8.041339^{*8}	5.118960*	4.241688*
INF	6.189908*	4.2911302*		5.144613*	5.014355*
R_EXCH	6.238925*	5.611705^{*5}	8.946542*		6.335598*
R_GDP	8.063436*	5.388462*	7.084845*	6.086234*	
Non-OPEC Countries					
OilV		4.291782*	4.146879*	9.079611*	3.834762*
Military_EXP	8.043617*		4.552067*	5.008411*	4.552067*
INF	7.858703*	5.731512*		4.68100*	5.010920*
R_EXCH	7.017210*	5.472625	5.90172*		5.005662*
R_GDP	4.184661*	7.898571	4.932855*	7.758531*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.22. Granger causality tests among the study's variables: Based on oil revenue volatility

Excluded	Dependent variable				
	OilrevenueV	Military_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrevenueV		5.003310*	5.242252*	3.989060*	3.187539*
Military_EXP	8.816785*		8.239694*	4.334068*	3.719885*
INF	7.970224*	4.205464*		4.923588*	5.203319*
R_EXCH	4.948842*	7.619521*	6.842284*		5.218759*
R_GDP	4.070622*	4.329088*	6.121096	7.000463*	
Non-OPEC Countries					
OilrevenueV		6.124846*	7.224217*	4.194411*	6.829559*
Military_EXP	4.469419*		8.183351*	4.031439*	4.169453*
INF	5.053545*	5.859523*		4.700351*	5.029658*
R_EXCH	5.756353*	5.332686*	9.807589*		5.095097*
R_GDP	5.136932*	7.243401*	9.206368*	6.731848*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.23. Granger causality tests among the study's variables: Based on oil rents volatility

Excluded	Dependent variable				
	OilrentsV	Military_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrentsV		7.085594*	4.215926*	7.679084*	4.581261*
Military_EXP	9.325329*		7.397858*	7.577266*	3.486717*
INF	8.110471*	6.539116*		4.111540*	7.105764*
R_EXCH	8.889103*	6.085734*	4.013677*		4.414927*
R_GDP	4.049362*	5.554375*	4.001236*	5.020114*	
Non-OPEC Countries					
OilrentsV		3.846634*	4.674181*	7.205407*	3.241931*
Military_EXP	7.261007*		4.010867*	6.008200*	5.660235*
INF	5.167643*	3.609782*		4.400277*	7.056258*
R_EXCH	5.038018*	4.094750*	9.12909*		7.142167*
R_GDP	4.777289*	5.459220*	5.979086*	8.613451*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.24. Granger causality tests among the study's variables: Based on oil price volatility

Excluded	Dependent variable				
	OilV	Health_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilV		5.159970*	5.693154*	4.540299*	5.798148*
Health_EXP	8.003328*		3.745669*	4.473470*	5.318426*
INF	7.895353*	6.054982*		3.621190*	5.036387*
R_EXCH	5.182369*	7.145777*	3.772523*		3.237031*
R_GDP	5.903119*	7.176286*	4.370212*	5.189501*	
Non-OPEC Countries					
OilV		7.185348*	4.102619*	5.114852*	3.046714*
Health_EXP	4.191248*		5.918951*	3.277087*	4.883258*
INF	5.055350*	9.989607*		5.450055*	4.069486*
R_EXCH	5.100057*	9.392850*	7.21869*		4.475589*
R_GDP	4.139435*	8.299484*	5.634433*	4.412051*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.25. Granger causality tests among the study's variables: Based on oil revenue volatility

Excluded	Dependent variable				
	OilrevenueV	Health_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrevenueV		0.070675***	0.483929***	3.042099**	2.060386***
Health_EXP	1.880354**		4.020089**	0.571605**	0.248007***
INF	1.034137**	0.077311**		2.677676***	0.000295*
R_EXCH	1.186527**	0.127190**	0.652893***		0.155244
R_GDP	1.259603**	0.144456*	0.491020	0.053150	
All variables	4.522169***	0.451136***	5.796766***	8.007326***	2.612331*
Non-OPEC Countries					
OilrevenueV		4.198204*	4.006503*	5.026392*	5.259997*
Health_EXP	5.246091*		5.873968*	3.094237*	4.701332*
INF	4.034602*	10.21380*		5.010113*	5.347310*
R_EXCH	4.790437*	9.454609*	7.150244*		6.989847*
R_GDP	5.664604*	7.185880*	8.783103*	6.354829*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.26. Granger causality tests among the study's variables: Based on oil rents volatility

Excluded	Dependent variable				
	OilrentsV	Health_EXP	INF	R_EXCH	R_GDP
OPEC Countries					
OilrentsV		4.831320*	5.287264*	7.728866*	4.429307*
Health_EXP	5.141424*		4.395463*	4.493953*	5.629381*
INF	4.404976*	5.105518*		3.512421*	4.83E-05*
R_EXCH	4.813478*	5.659279*	6.917407*		4.251126*
R_GDP	9.950523*	6.030318*	6.137746*	9.099929*	
Non-OPEC Countries					
OilrentsV		8.769976*	8.799637*	4.278349*	3.033574*
Health_EXP	7.590871*		4.046579*	3.315094*	3.574263*
INF	7.247752*	10.70515*		5.48426*	4.325304*
R_EXCH	6.000361*	9.577176*	7.66021*		5.843041*
R_GDP	7.467845*	8.307406*	8.622980*	4.280102*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.27. Granger causality tests among the study's variables: Based on CROSS_1_1 and GOV_EXP

Excluded	Dependent variable					
	CROSS_1_1	CROSS_1_1	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_1			4.345416*	5.816653*	5.415180*	9.431724*
GOV_EXP	4.005415*	-		7.468336**	3.844832**	0.394961*
INF	6.684243*	-	4.019890*		10.40379*	6.172376*
R_EXCH	4.012486*	-	4.653761*	9.49935*		6.340509*
R_GDP	4.096655*	-	3.282793*	9.638307*	0.127570*	
Non- democratic countries						
CROSS_1_1			6.570236*	6.814282*	7.846509*	7.528439*
GOV_EXP	-	5.646060*		6.371874*	8.902344*	7.467659*
INF	-	5.003380*	8.028557*		10.94156*	6.195257*
R_EXCH	-	7.804609*	6.409596*	9.434508*		6.349983*
R_GDP	-	8.162503*	9.808640*	5.505088*	6.092567*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.28. Granger causality tests among the study's variables: Based on CROSS_1_2 and GOV_EXP

Excluded	Dependent variable					
	CROSS_1_2	CROSS_1_2	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_2			7.031252*	5.944758*	4.954831*	5.342752*
GOV_EXP	7.006101*	-		0.478397*	2.815260*	5.398112*
INF	4.022952*	-	5.012602*		12.13949*	6.285673*
R_EXCH	4.001634*	-	7.772301*	5.500957*		5.552238*
R_GDP	5.186188*	-	8.281249*	6.645966*	6.129863	
Non- democratic countries						
CROSS_1_2			5.380106*	7.128104*	5.181447*	6.454706*
GOV_EXP	-	9.120070*		5.578451*	4.607291*	6.299066*
INF	-	9.080800*	5.009785*		11.08090*	4.214883*
R_EXCH	-	5.253669*	4.666537*	5.261100*		5.331185*
R_GDP	-	4.218482*	4.168471*	8.588771*	9.142501*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.29. Granger causality tests among the study's variables: Based on CROSS_1_3 and GOV_EXP

Excluded	Dependent variable					
	CROSS_1_3	CROSS_1_3	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_3			4.029617*	8.162502*	3.963414*	4.352730*
GOV_EXP	10.050984*	-		9.486898*	4.581280*	4.588054*
INF	3.764790*	-	5.123118*		5.998023*	5.054392*
R_EXCH	4.533131*	-	5.092730*	8.815049*		6.488534*
R_GDP	5.489582*	-	3.839674*	5.503413*	6.763474*	
Non- Democratic countries						
CROSS_1_3			5.826330*	8.246936*	7.347172*	6.042832*
GOV_EXP	-	5.021693*		8.496576*	7.409405	7.502576*
INF	-	5.415956*	4.116398*		7.618698*	7.938967*
R_EXCH	-	5.865883*	6.762612*	7.043926*		8.220021*
R_GDP	-	6.112232*	3.441584*	9.206126*	8.602139*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.30. Granger causality tests among the study's variables: Based on CROSS_2_1 and GOV_EXP

Excluded	Dependent variable					
	CROSS_2_1	CROSS_2_1	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_1			6.402635*	7.875917*	5.804594*	4.423493*
GOV_EXP	5.053107*	-		9.439505*	3.977391	5.409720*
INF	5.730863*	-	7.021153*		10.33688*	7.171633*
R_EXCH	6.031737*	-	7.644411*	9.400928*		7.341790*
R_GDP	6.295535*	-	8.273722*	10.628723*	8.122814	
Non- Democratic countries						
CROSS_2_1			4.403370*	5.714668*	5.311338*	5.088681*
GOV_EXP	-	4.301709*		8.547695*	9.540236*	6.349683*
INF	-	5.000934*	6.024214*		10.88893*	8.175865*
R_EXCH	-	5.800323*	7.511314*	9.65634*		9.414876*
R_GDP	-	5.958146*	4.146309*	10.586675*	11.108876*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.31. Granger causality tests among the study's variables: Based on CROSS_2_2 and GOV_EXP

Excluded	Dependent variable					
	CROSS_2_2	CROSS_2_2	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_2			9.008144*	4.237965*	6.183774*	8.443549*
GOV_EXP	4.020167*	-		8.438416*	12.995616*	8.426006*
INF	4.392869*	-	8.011394*		12.29067*	8.288780*
R_EXCH	6.001014*	-	7.742768*	45.11698*		4.571449
R_GDP	7.465851*	-	3.281721*	10.641636*	0.127728	
Non- Democratic countries						
CROSS_2_2			4.128231*	5.110678*	5.038468*	4.232795*
GOV_EXP	-	10.169162*		6.607863*	3.569014*	5.181494*
INF	-	9.102310*	5.010626*		11.09453*	8.207572*
R_EXCH	-	9.120605*	5.708011*	50.47827*		9.344414*
R_GDP	-	8.513051*	7.273551*	10.631183*	12.128432*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.32. Granger causality tests among the study's variables: Based on CROSS_2_3 and GOV_EXP

Excluded	Dependent variable					
	CROSS_2_3	CROSS_2_3	GOV_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_3			5.009355*	4.242624*	4.485382*	4.429572*
GOV_EXP	8.092793*	-		10.450790*	9.640610*	9.607886*
INF	4.102359*	-	6.117401*		10.013546*	10.064561*
R_EXCH	9.624947*	-	10.060944*	8.61155*		11.517516*
R_GDP	10.690663*	-	13.838078*	12.501279*	10.760753*	
Non- Democratic countries						
CROSS_2_3			4.972165*	4.191594*	4.933587*	4.179651*
GOV_EXP	-	10.382425*		10.610025*	5.328884*	5.500882*
INF	-	6.403567*	6.114981*		5.618182*	5.936861*
R_EXCH	-	5.716042*	8.840221*	7.499009*		10.316574*
R_GDP	-	4.081761*	3.093512*	12.326166*	7.588683*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.33. Granger causality tests among the study's variables: Based on CROSS_1_1 and Education_EXP

Excluded	Dependent variable					
	CROSS_1_1	CROSS_1_1	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_1			5.024168*	9.803846*	12.227594*	8.544201*
Education_EXP	10.560899*	-		10.158762*	10.214087*	10.190506*
INF	9.667540*	-	4.579871*		9.136100*	11.138100*
R_EXCH	8.024074*	-	3.092520*	49.62188*		12.303737*
R_GDP	7.072953*	-	6.219193*	11.534083*	8.182070*	
Non- democratic countries						
CROSS_1_1			9.109759*	4.855941*	10.563169*	6669603.*
Education_EXP	-	3.322804*		5.116741*	10.174892*	11.292042*
INF	-	4.028804*	13.660130*		9.620451*	10.155328*
R_EXCH	-	7.631081*	12.226962*	49.76490*		10.304090*
R_GDP	-	3.550718*	10.101683*	11.415445*	8.145581*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.34. Granger causality tests among the study's variables: Based on CROSS_1_1 and Military_EXP

Excluded	Dependent variable					
	CROSS_1_1	CROSS_1_1	Military_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_1			6.041590*	9.002268*	11.493579*	10.062691*
Military_EXP	8.448014*	-		8.138453*	10.048722*	13.353297*
INF	10.856114*	-	7.244392*		9.429930*	16.202797*
R_EXCH	13.37E-05*	-	8.185396*	49.55697*		5.396736*
R_GDP	14.137569*	-	10.985634*	11.537610*	10.207794*	
Non- democratic countries						
CROSS_1_1			4.864770***	6.067451*	10.255871*	8.129371*
Military_EXP	-	11.759711**		7.109468*	11.434487*	3.396319*
INF	-	10.101314*	5.411870*		9.955946*	6.206330*
R_EXCH	-	9.280225*	10.071263*	49.69760*		10.401107*
R_GDP	-	5.063198*	11.820971	11.401603*	10.188792	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.35. Granger causality tests among the study's variables: Based on CROSS_1 and Health_EXP

Excluded	Dependent variable					
	CROSS_1_1	CROSS_1_1	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_1			4.417981*	10.470550*	9.106458*	1.310436*
Health_EXP	14.36032*	-		17.24575*	9.285199*	2.247203*
INF	10.499230*	-	9.214534*		8.527221*	0.152187*
R_EXCH	9.166747*	-	9.207325*	42.92592*		0.070755*
R_GDP	6.050904*	-	8.004109*	10.469066*	10.000417*	
Non- democratic countries						
CROSS_1_1			5.346036*	0.585499*	5.355997*	11.474831*
Health_EXP	-	20.51481*		17.26740*	9.190563*	12.387842*
INF	-	18.96E-05*	8.836844*		8.737850*	10.184814*
R_EXCH	-	10.000992*	9.243128*	42.79090*		6.060456*
R_GDP	-	4.332840*	10.002429*	0.522763*	3.99E-06*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.36. Granger causality tests among the study's variables: Based on CROSS_1_2 and Education_EXP

Excluded	Dependent variable					
	CROSS_1_2	CROSS_1_2	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_2			9.353545*	11.943881*	4.756042*	8.428251*
Education_EXP	10.323316*	-		10.180729*	8.174712*	9.166461*
INF	13.944117*	-	9.916145*		10.74303*	10.249964*
R_EXCH	15.000295*	-	10.826259*	45.56329*		10.508860*
R_GDP	20.163428*	-	14.205211*	11.537981*	0.182479*	
Non- democratic countries						
CROSS_1_2			5.267731*	8.077493*	7.093793*	7.608458*
Education_EXP	-	5.667497*		10.230957*	8.076952*	8.135752*
INF	-	7.014906*	4.885978*		9.774631*	11.192794*
R_EXCH	-	4.564015*	6.835946*	50.18758*		10.311746*
R_GDP	-	8.330915*	7.157935*	41.481020*	10.184419*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.37. Granger causality tests among the study's variables: Based on CROSS_1_2 and Military_EXP

Excluded	Dependent variable					
	CROSS_1_2	CROSS_1_2	Military_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_2			8.015084*	12.114849*	4.057752*	9.814069*
Military_EXP	3.312017*	-		10.132564*	8.049048*	3.196722*
INF	4.408595*	-	9.306606*		10.91959*	5.272771*
R_EXCH	5.026383*	-	10.174612*	45.49683*		7.589116*
R_GDP	6.278227*	-	11.982177*	15.546104*	11.209958*	
Non- democratic countries						
CROSS_1_2			5.231085*	9.132833*	7.426366*	4.068249*
Military_EXP	-	7.771681*		8.067922*	6.978116*	3.239204*
INF	-	8.138040*	4.294777*		10.15994*	4.225423*
R_EXCH	-	9.122679*	5.099599*	49.90055*		5.398825*
R_GDP	-	10.079821*	6.887459*	10.492754*	10.257340*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.38. Granger causality tests among the study's variables: Based on CROSS_1_2 and Health_EXP

Excluded	Dependent variable					
	CROSS_1_2	CROSS_1_2	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_2			4.858942*	10.172007*	2.145935*	4.164220*
Health_EXP	17.47046*	-		15.77826*	6.763585*	6.191243*
INF	12.886265*	-	7.999447*		9.336488*	6.324059*
R_EXCH	10.224056*	-	8.114987*	40.89657*		5.223146*
R_GDP	10.016074*	-	7.000345*	10.543810*	10.002900*	
Non- democratic countries						
CROSS_1_2			11.161143*	5.369337*	11.030430*	8.966425*
Health_EXP	-	7.089903*		17.97120*	10.25885*	5.783150*
INF	-	5.002212*	8.289053*		18.507206*	6.233011*
R_EXCH	-	4.044518*	8.189021*	43.06650*		6.087198*
R_GDP	-	4.617914*	7.005640*	10.543006*	10.000633*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.39. Granger causality tests among the study's variables: Based on CROSS_1_3 and Education_EXP

Excluded	Dependent variable					
	CROSS_1_3	CROSS_1_3	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_3			11.549699*	10.213808*	3.759196*	6.368202*
Education_EXP	10.765075*	-		10.263964*	4.012137*	11.084092*
INF	3.884659*	-	8.876382*		5.766855*	10.909035*
R_EXCH	8.544921*	-	3.268173*	67.89648*		5.313972*
R_GDP	5.410344*	-	5.313199*	12.296249*	6.806459*	
Non- democratic countries						
CROSS_1_3			14.036657*	10.253128*	7.306538*	6.014831*
Education_EXP	-	4.654509*		10.228493*	3.002226*	5.954955*
INF	-	5.243690*	11.549022*		4.467361*	10.808296*
R_EXCH	-	2.435234*	12.968438*	71.42551*		5.073770*
R_GDP	-	6.040331*	10.062836*	12.021420*	6.638812*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.40. Granger causality tests among the study's variables: Based on CROSS_1_3 and Military_EXP

Excluded	Dependent variable					
	CROSS_1_3	CROSS_1_3	Military_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_3			8.159107*	5.294859*	13.369288*	6.105873*
Military_EXP	11.947856*	-		5.181413*	8.668467*	3.597699*
INF	14.382820*	-	7.767791*		8.834744*	5.002095*
R_EXCH	10.848589*	-	5.569396*	67.73442*		5.520143*
R_GDP	10.584129*	-	3.641742*	12.328575*	8.870998*	
Non- democratic countries						
CROSS_1_3			0.500831*	10.376749*	4.195562*	7.219607*
Military_EXP	-	0.783255*		10.188492*	5.934794*	3.938794*
INF	-	0.113382*	0.737401*		5.553716*	4.971231*
R_EXCH	-	1.721075*	0.437714*	71.20681*		8.373200*
R_GDP	-	0.118323*	2.204828*	18.988196*	5.741627*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.41. Granger causality tests among the study's variables: Based on CROSS_1_3 and Health_EXP

Excluded	Dependent variable					
	CROSS_1_3	CROSS_1_3	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_1_3			10.711736*	10.386987*	11.226102*	4.810485*
Health_EXP	16.25124*	-		15.81650*	7.573416*	5.903413*
INF	3.361430*	-	7.606188*		5.528927*	6.949776*
R_EXCH	6.703565*	-	5.233650*	61.25138*		6.805170*
R_GDP	6.002924*	-	5.108060*	12.849592*	5.202178	
Non- democratic countries						
CROSS_1_3			5.361397*	10.292469*	6.114356*	7.006314*
Health_EXP	-	21.69272*		15.64101*	9.937697*	5.322193*
INF	-	20.265365*	8.461618*		7.378261*	4.780183*
R_EXCH	-	17.434919*	9.361397*	61.23376*		4.592721*
R_GDP	-	15.058726*	10.528587	11.011110*	8.194501*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.42. Granger causality tests among the study's variables: Based on CROSS_2_1 and Education_EXP

Excluded	Dependent variable					
	CROSS_2_1	CROSS_2_1	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_1			5.383821*	10.883946*	12.501796*	10.525208*
Education_EXP	10.597228*	-		9.150753*	6.231401*	11.194515*
INF	8.751345*	-	6.555323*		9.052785*	9.136229*
R_EXCH	8.037404*	-	12.107843*	49.59739*		8.301983*
R_GDP	7.247372*	-	10.212895*	11.527626*	10.178360*	
Non- democratic countries						
CROSS_2_1			3.691259*	9.646341*	11.375168*	12.381402*
Education_EXP	-	8.405182*		10.182599*	10.161579*	11.324506*
INF	-	9.001848*	10.768103*		9.644436*	10.150432*
R_EXCH	-	10.844505*	12.038036*	49.60973*		9.391410*
R_GDP	-	11.149629*	10.171840*	1.479400*	8.154523*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.43. Granger causality tests among the study's variables: Based on CROSS_2_1 and Military_EXP

Excluded	Dependent variable					
	CROSS_2_1	CROSS_2_1	Military_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_1			10.035924*	11.091873*	5.733936*	5.059422*
Military_EXP	8.385526*	-		10.139890*	6.0232749*	3.373151*
INF	7.947983*	-	11.244367*		9.340683*	5.202195*
R_EXCH	7.001021*	-	12.183482*	49.54521*		6.396117*
R_GDP	10.358369*	-	14.986820*	11.528555*	5.203298*	
Non- democratic countries						
CROSS_2_1			10.014333*	9.865642*	10.672027*	4.916395*
Military_EXP	-	4.048085*		10.183207*	11.025548*	5.502907*
INF	-	7.054619*	11.305027*		9.916192*	5.186098*
R_EXCH	-	8.413466*	12.146729*	49.59840*		6.448163*
R_GDP	-	10.770143*	16.964156*	11.466976*	8.188104*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.44. Granger causality tests among the study's variables: Based on CROSS_2_1 and Health_EXP

Excluded	Dependent variable					
	CROSS_2_1	CROSS_2_1	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_1			13.974312*	10.468668*	0.150737*	8.304077*
Health_EXP	17.72758*	-		17.15229*	7.070523*	5.263920*
INF	15.570259*	-	9.220332*		8.492297*	5.148045*
R_EXCH	10.184077*	-	8.213992*	42.90374*		5.069021*
R_GDP	9.002492*	-	5.002918*	10.471239*	5.000529*	
Non- democratic countries						
CROSS_2_1			4.377710*	10.641189*	8.000124*	4.176693*
Health_EXP	-	16.62792*		17.61161*	7.987600*	3.405453*
INF	-	8.017229*	8.589169*		8.660612*	6.200591*
R_EXCH	-	4.076958*	10.194075*	43.03065*		6.087933*
R_GDP	-	4.374670*	5.49E-05	10.491417**	4.88E-06*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.45. Granger causality tests among the study's variables: Based on CROSS_2_2 and Education_EXP

Excluded	Dependent variable					
	CROSS_2_2	CROSS_2_2	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_2			8.480685*	12.263165*	5.829360*	5.524359*
Education_EXP	4.429226*	-		10.166726*	10.200921*	6.189701*
INF	4.436543*	-	7.925529*		10.83265*	6.249898*
R_EXCH	4.000108*	-	5.880179*	45.25547*		6.522263*
R_GDP	6.415567*	-	4.205277*	41.538041	10.182532*	
Non- democratic countries						
CROSS_2_2			10.219216*	6.044882*	4.001578*	11.461675*
Education_EXP	-	4.208650*		5.245151*	8.089646*	12.092732*
INF	-	5.004323*	8.864659*		9.807495*	10.200239*
R_EXCH	-	4.479088*	7.674763*	50.33586*		10.346845*
R_GDP	-	4.629714*	5.198875*	11.511313*	9.172264*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.46. Granger causality tests among the study's variables: Based on CROSS_2_2 and Military_EXP

Excluded	Dependent variable					
	CROSS_2_2	CROSS_2_2	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_5			10.029648*	12.452651*	5.070939*	9.891694*
Military_EXP	3.086315*	-		10.136853*	1.017469*	3.201627*
INF	4.939981*	-	11.312083*		1099704*	7.272983*
R_EXCH	5.037774*	-	9.193611*	45.21453*		6.602458
R_GDP	6.592637*	-	8.983261*	9.543218*	5.207942*	
Non- democratic countries						
CROSS_2_2			10.000163*	4.083988*	12.134005*	10.417418*
Military_EXP	-	10.37380*		5.065881*	11.790016*	12.690323*
INF	-	9.100214*	11.295359*		10.15488*	8.226070*
R_EXCH	-	9.088605*	8.162735*	50.03863*		4.422203*
R_GDP	-	7.262721*	7.979971*	11.536355*	10.226357*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.47. Granger causality tests among the study's variables: Based on CROSS_2_2 and Health_EXP

Excluded	Dependent variable					
	CROSS_2_2	CROSS_2_2	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_2			5.846541*	9.234958*	12.793572*	8.317439*
Health_EXP	20.35992*	-		15.49960*	16.367528*	8.271478*
INF	13.252542*	-	8.012061*		19.435339*	7.326119*
R_EXCH	10.286294*	-	8.115877*	40.76904*		8.230371*
R_GDP	10.005976*	-	4.000331*	18.547955*	10.003866*	
Non- democratic countries						
CROSS_2_2			5.098570*	10.310195*	8.290750*	6.022695*
Health_EXP	-	4.440001*		17.95837*	9.610429*	7.942363*
INF	-	5.000190*	8.288697*		8.568334*	7.246482*
R_EXCH	-	6.064496*	9.188897*	43.03164*		6.102135*
R_GDP	-	6.922208*	10.001338*	10.512224*	2.43E-05*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.48. Granger causality tests among the study's variables: Based on CROSS_2_3 and Education_EXP

Excluded	Dependent variable					
	CROSS_2_3	CROSS_2_3	Education_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_3			5.721116*	8.320047*	14.225158*	10.438805*
Education_EXP	10.908023*	-		10.254036*	8.016182*	11.097696*
INF	4.282354*	-	6.877076*		7.768334*	8.913489*
R_EXCH	5.662388*	-	6.298870*	67.76932*		7.334171*
R_GDP	5.585524*	-	7.313307*	12.296956*	6.807308*	
Non- democratic countries						
CROSS_2_3			11.268846*	10.124865*	8.973974*	10.277562*
Education_EXP	-	5.508495*		10.268657*	7.002674*	11.079419*
INF	-	6.368936*	11.594731*		5.483806*	12.814641*
R_EXCH	-	7.746307*	12.817280*	71.28100*		13.179516*
R_GDP	-	8.036615*	10.187138*	12.153151*	3.609916*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

Appendix A.49. Granger causality tests among the study's variables: Based on CROSS_2_3 and Military_EXP

Excluded	Dependent variable					
	CROSS_2_3	CROSS_2_3	Military_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_3			5.206586*	6.417772*	3.829766*	5.150583*
Military_EXP	11.877044*	-		7.188160*	4.667498*	3.585324*
INF	14.821622*	-	5.772788*		5.836191*	8.009893*
R_EXCH	15.006201*	-	4.582417*	7.62580*		9.546620*
R_GDP	10.796297*	-	4.643686*	8.326390*	9.869865*	
Non- democratic countries						
CROSS_2_3			5.008275*	10.230083*	8.631181*	10.002876*
Military_EXP	-	3.649534*		10.210288*	7.703561*	9.580479*
INF	-	4.184486*	9.711596*		7.556952*	8.951936*
R_EXCH	-	5.948058*	10.485969*	71.10447*		8.426875*
R_GDP	-	5.153815*	12.624758*	12.126850*	5.704585*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

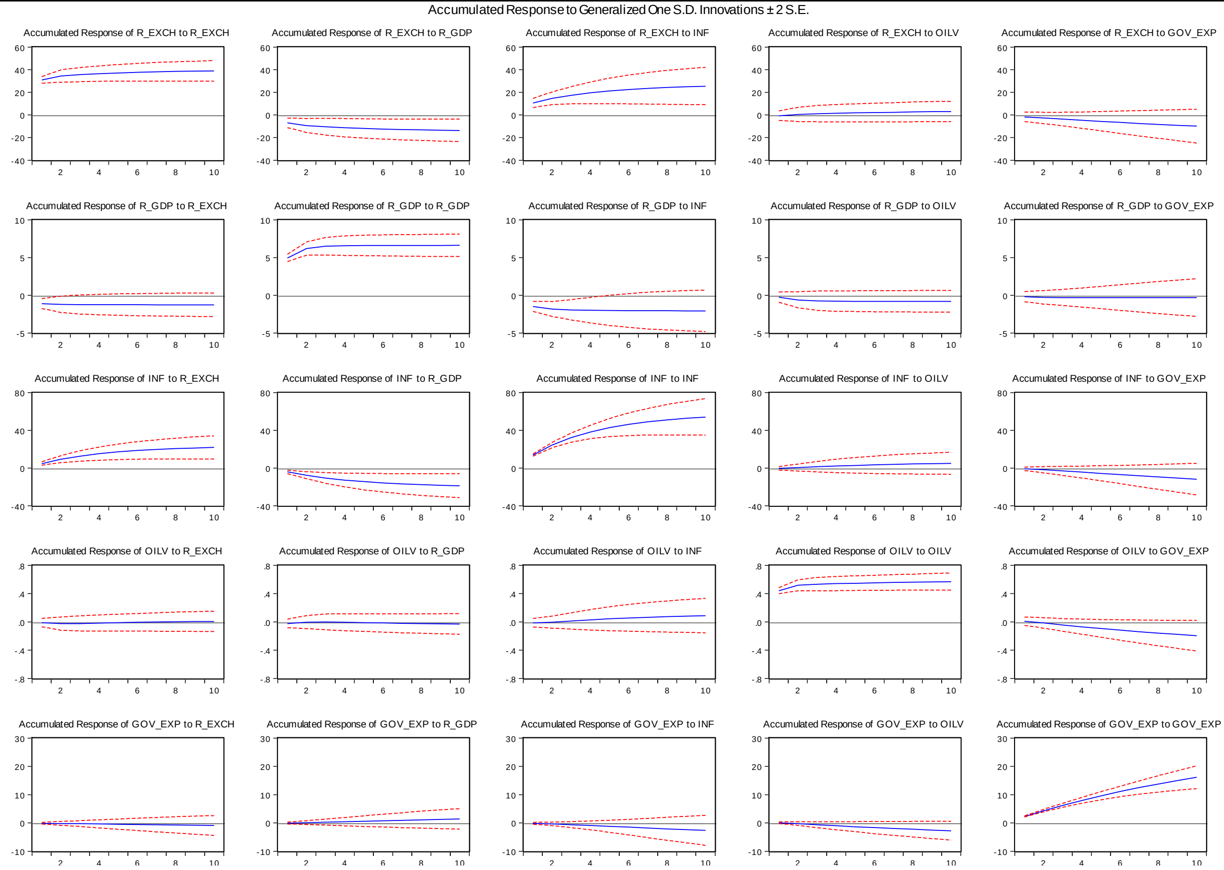
Appendix A.50. Granger causality tests among the study's variables: Based on CROSS_2_3 and Health_EXP

Excluded	Dependent variable					
	CROSS_2_3	CROSS_2_3	Health_EXP	INF	R_EXCH	R_GDP
Democratic countries						
CROSS_2_3			5.710764*	10.278766*	5.478941*	4.920879*
Health_EXP	18.38917*	-		15.58396*	7.364259*	5.956858*
INF	3.740297*	-	7.642207**		7.536384*	6.952587*
R_EXCH	4.034472*	-	8.239483**	61.07684*		6.811897*
R_GDP	4.020939*	-	10.107856*	0.856130	9.206769	
Non- democratic countries						
CROSS_2_3			9.137331*	10.451379*	8.025218*	7.621234*
Health_EXP	-	18.97022*		15.98038*	9.165505*	8.799941*
INF	-	10.446041*	8.157424*		7.378072*	9.798209*
R_EXCH	-	9.763759*	5.280482*	61.46477*		10.630547*
R_GDP	-	5.081308*	4.349168*	10.991120*	8.152742*	

Note: The numbers is the table are the Chi-square block exogeneity Wald tests. Under the null hypothesis, the excluded variables do not Granger-cause the dependent variable. *, **, and *** denotes significance at the 10%, 5% and 1% level.

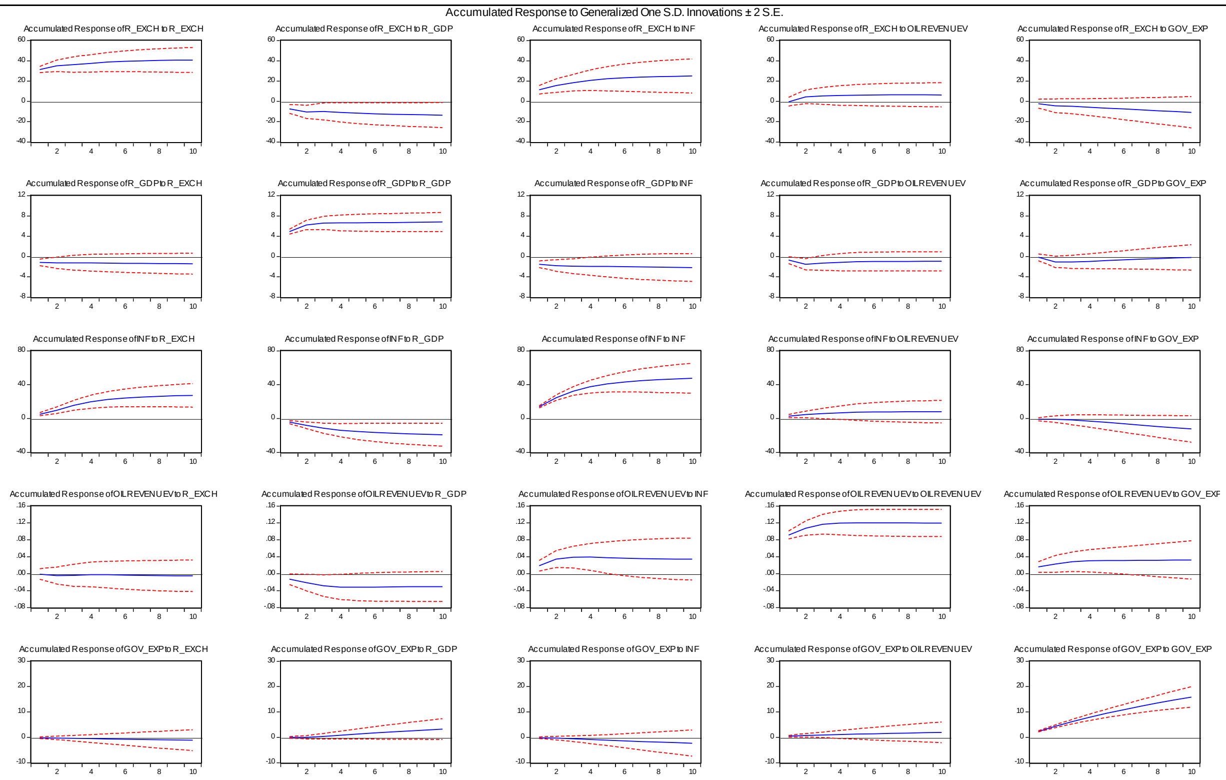
Appendix B: Empirical studies on oil volatility on aggregated government expenditure

Appendix B.1. Cumulative generalised impulse responses of oil price volatility in OPEC countries



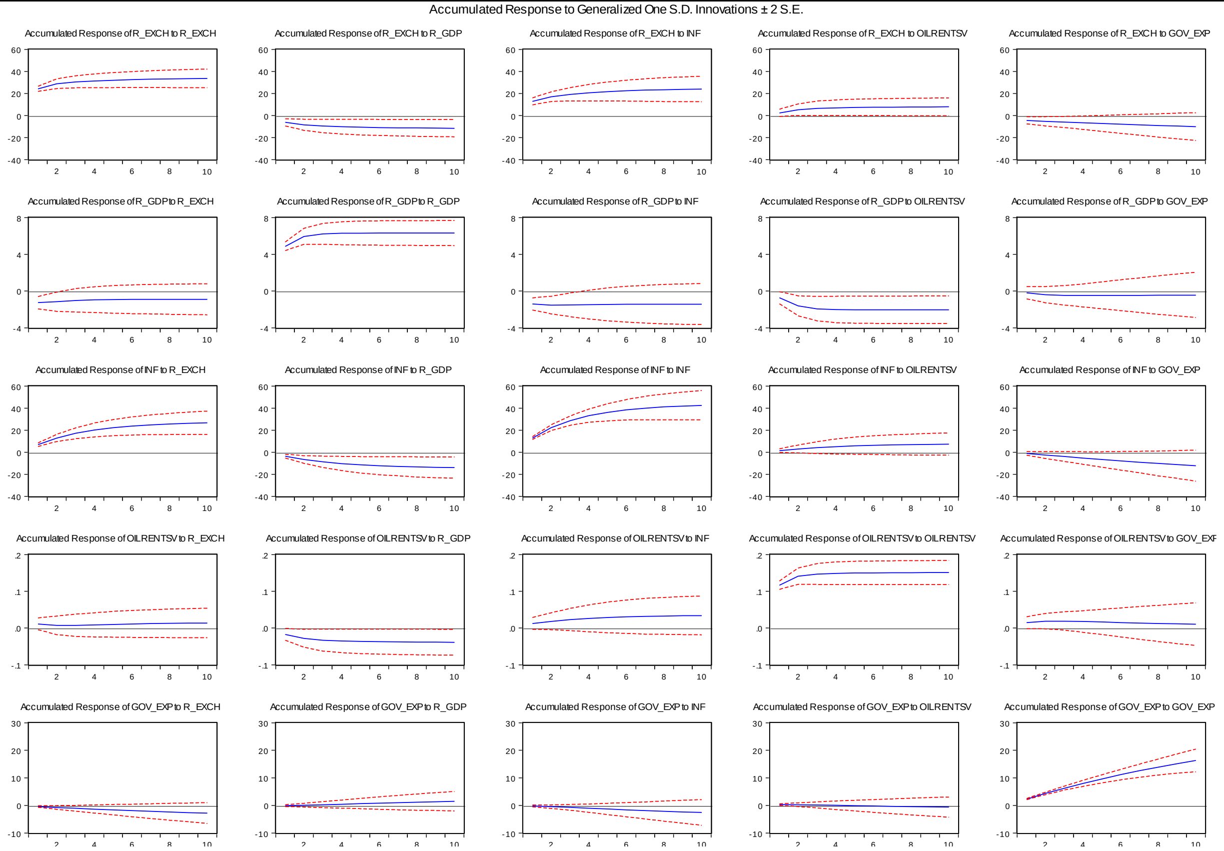
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, GOV_EXP= government spending

Appendix B.2. Cumulative generalised impulse responses of oil revenue volatility in OPEC countries



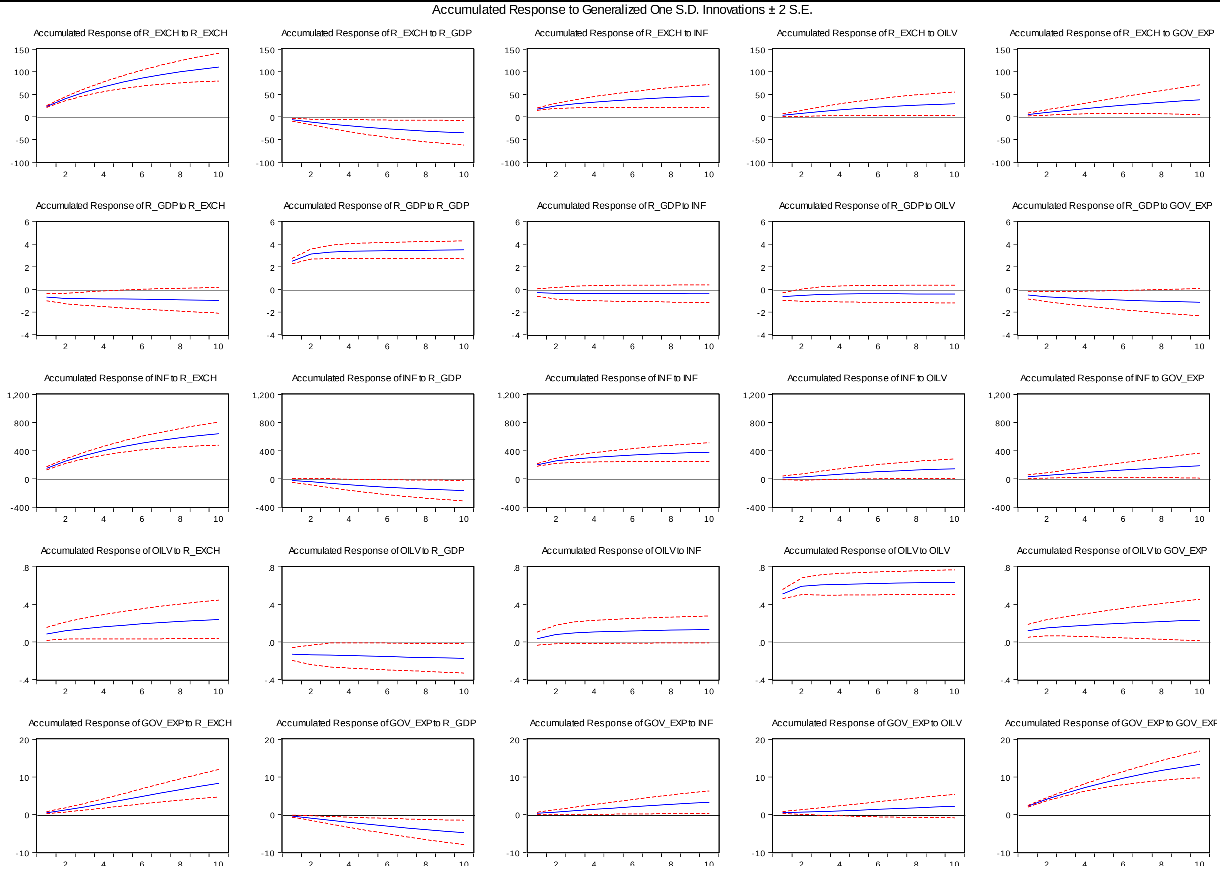
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, GOV_EXP= government spending

Appendix B.3. Cumulative generalised impulse responses of oil rents volatility in OPEC countries



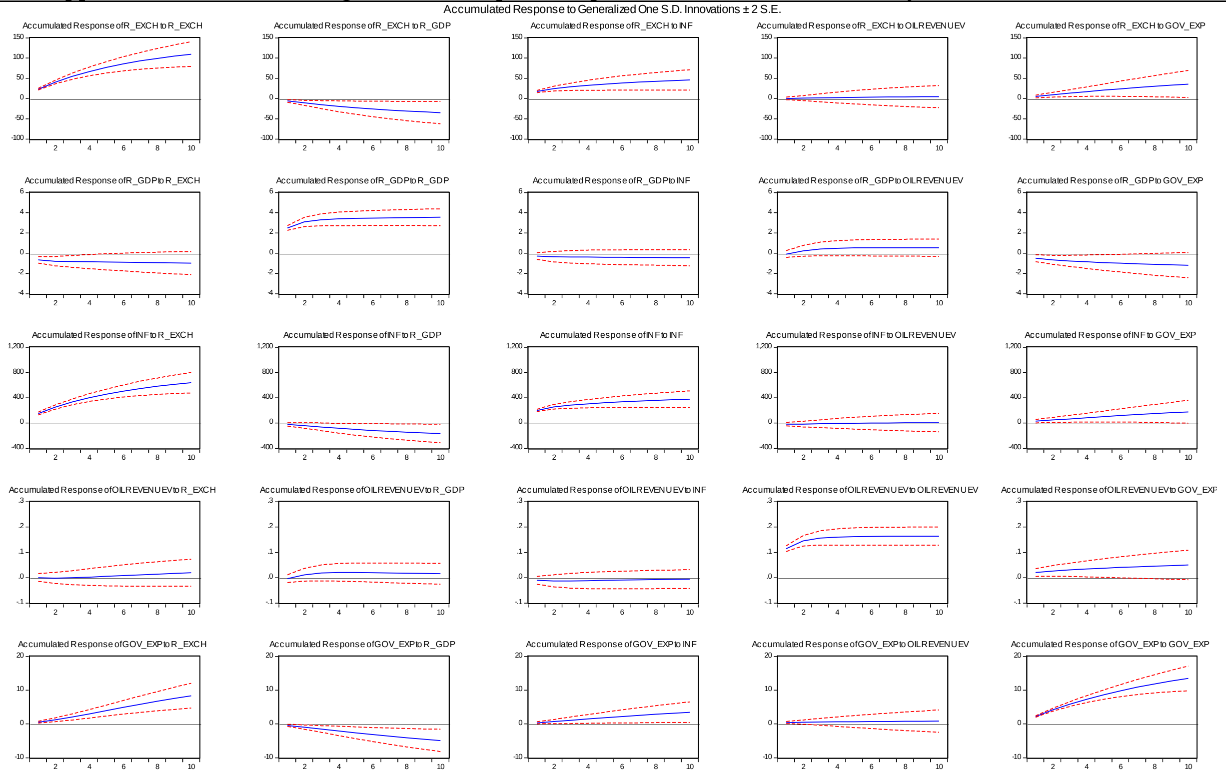
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, GOV_EXP= government spending

Appendix B.4. Cumulative generalised impulse responses of oil price volatility in non-OPEC countries



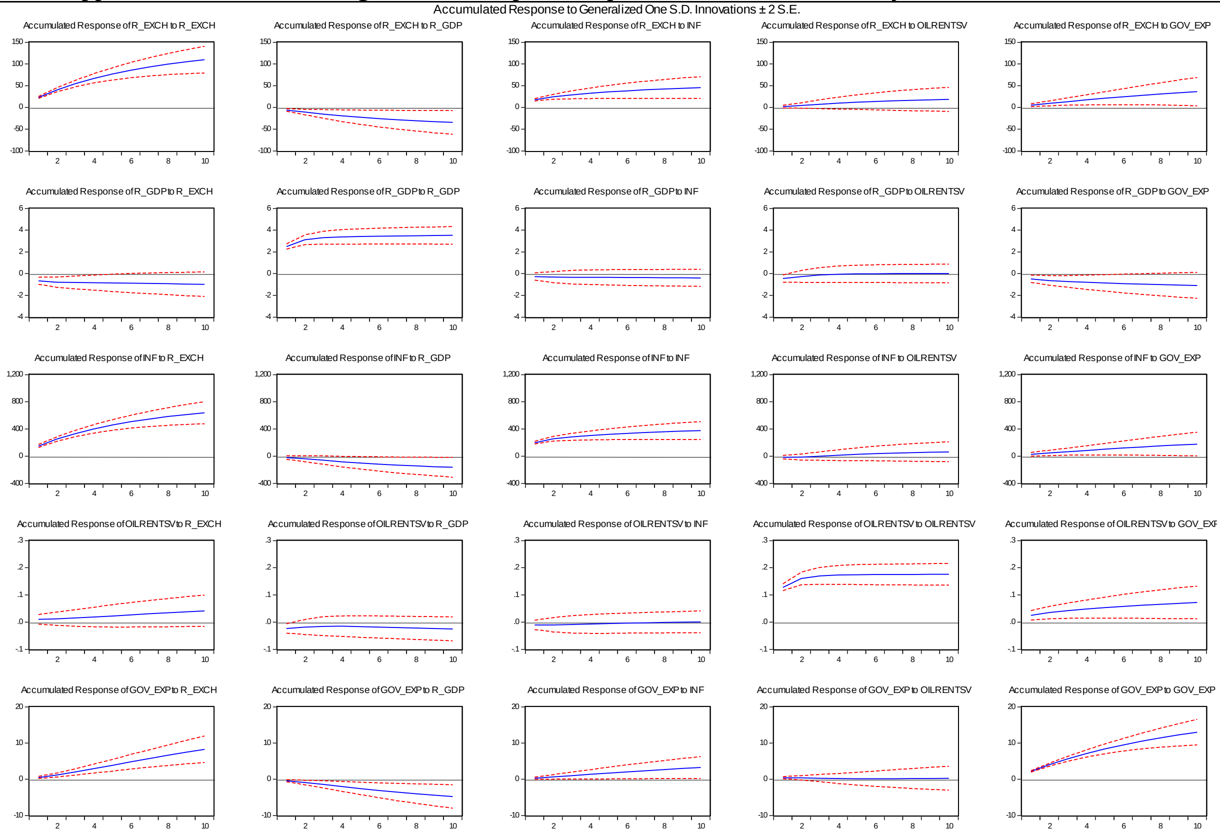
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, GOV_EXP= government spending

Appendix B.5. Cumulative generalised impulse responses of oil revenue volatility in non-OPEC countries



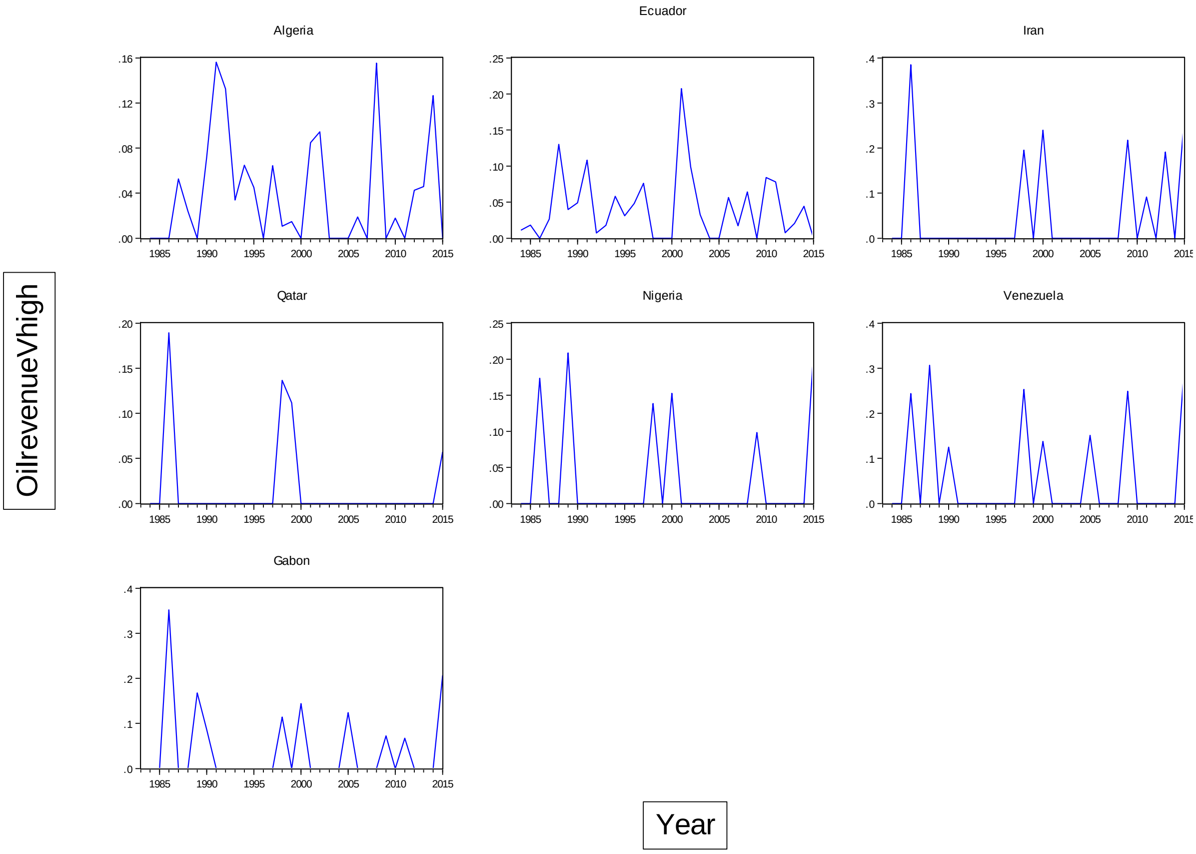
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, GOV_EXP= government spending

Appendix B.6. Cumulative generalised impulse responses of oil rents volatility in non-OPEC countries

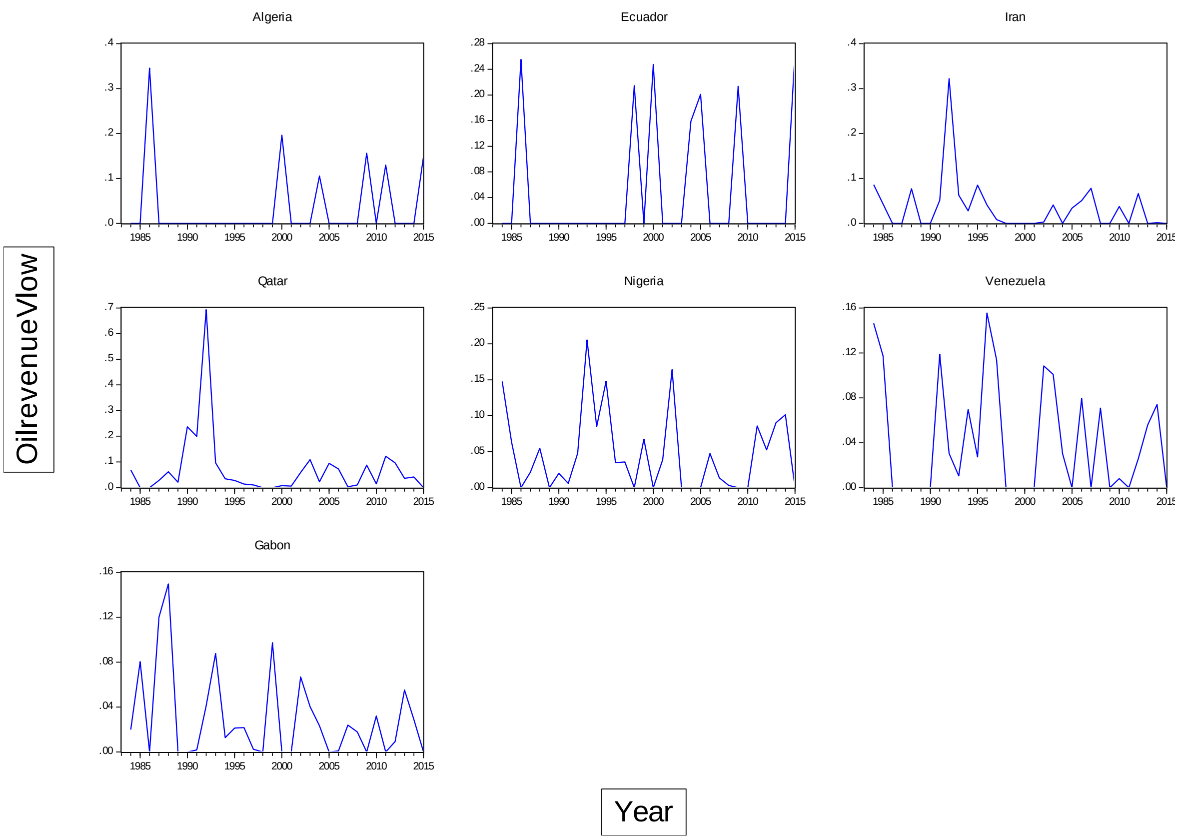


Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, GOV_EXP= government spending

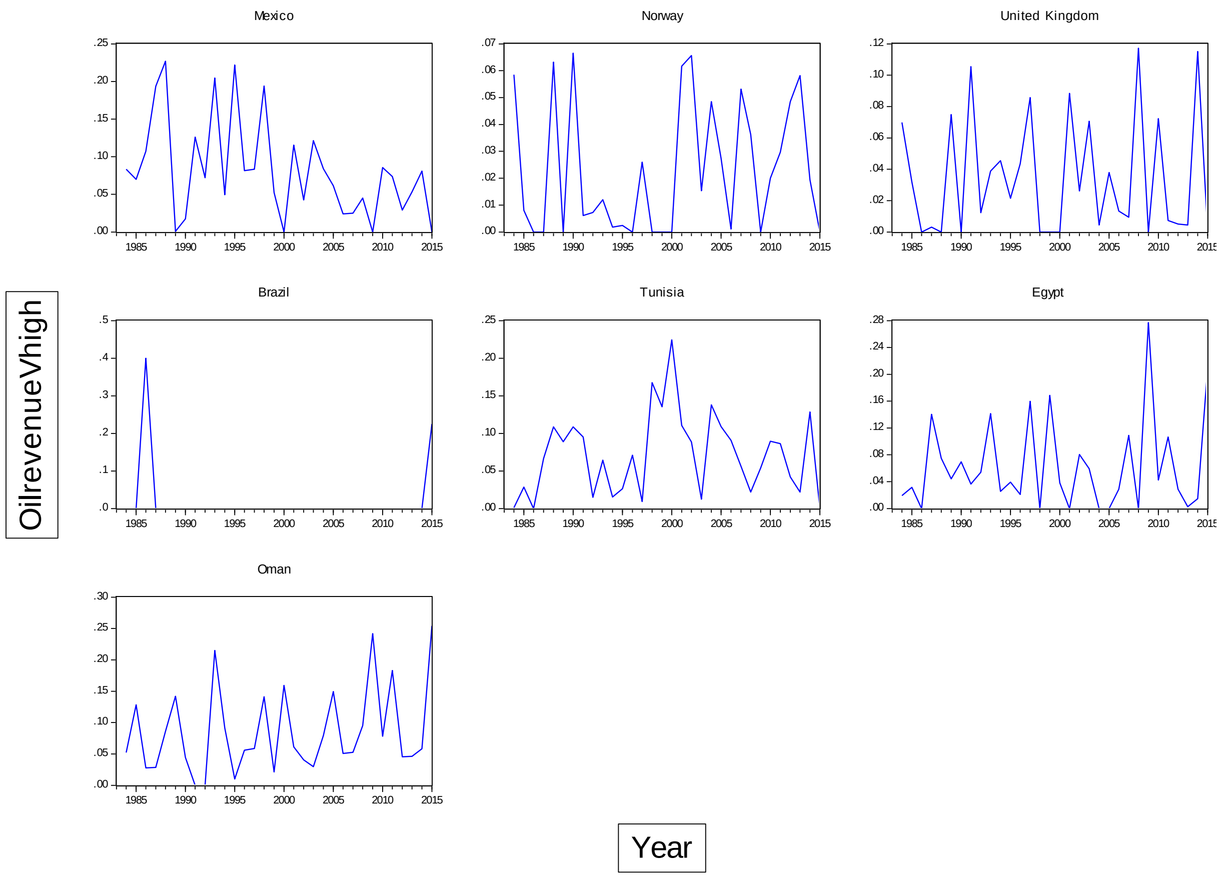
Appendix B.7. Oil revenue high volatility for seven oil exporting OPEC countries



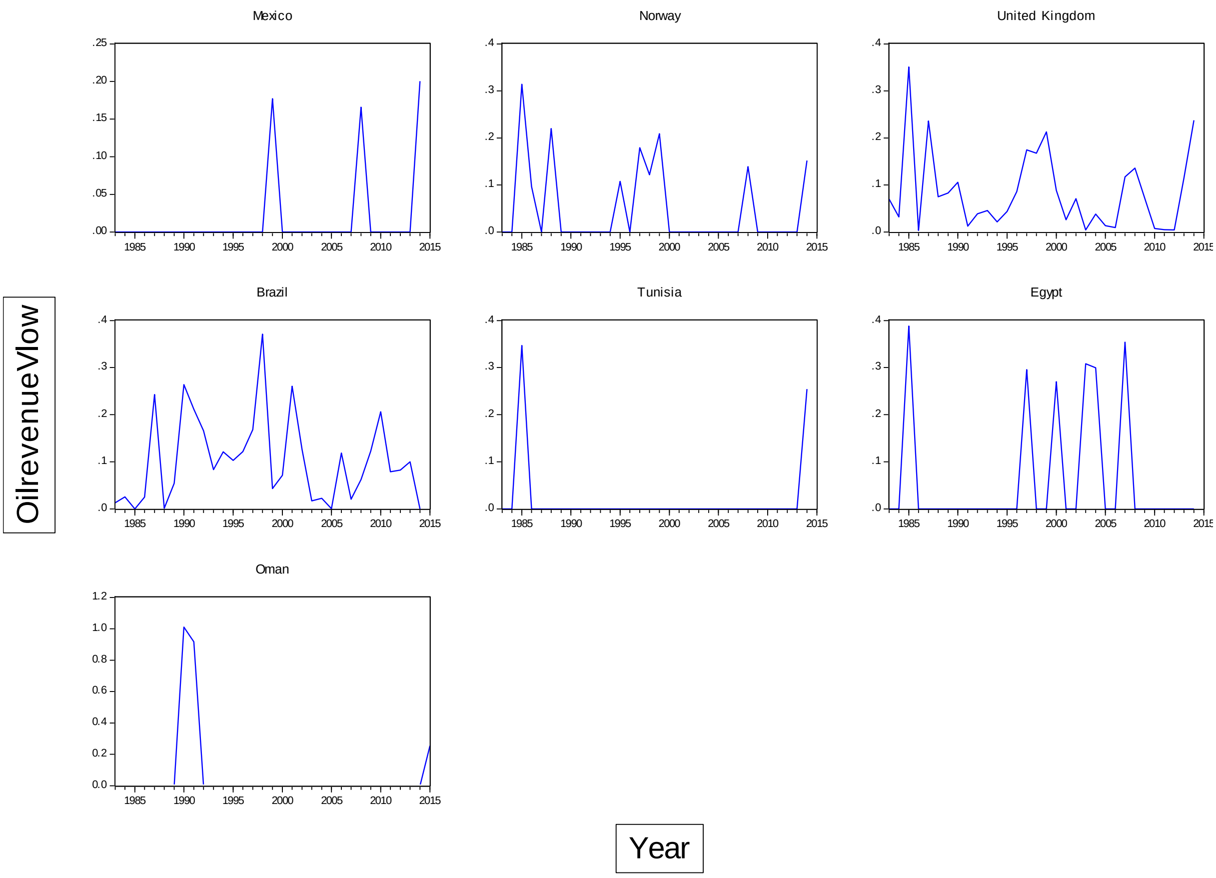
Appendix B.8. Oil revenue low volatility for seven oil exporting OPEC countries



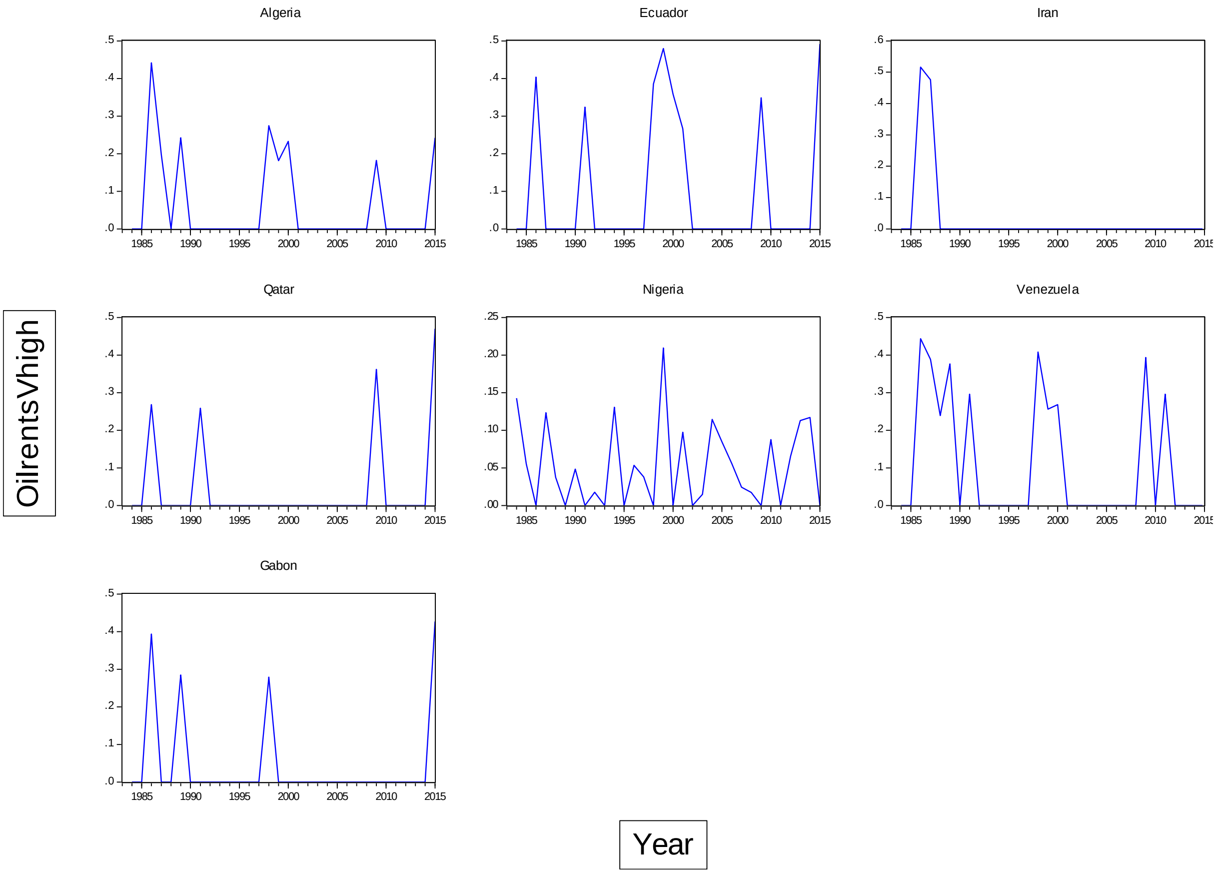
Appendix B.9. Oil revenue high volatility for seven oil exporting non-OPEC countries



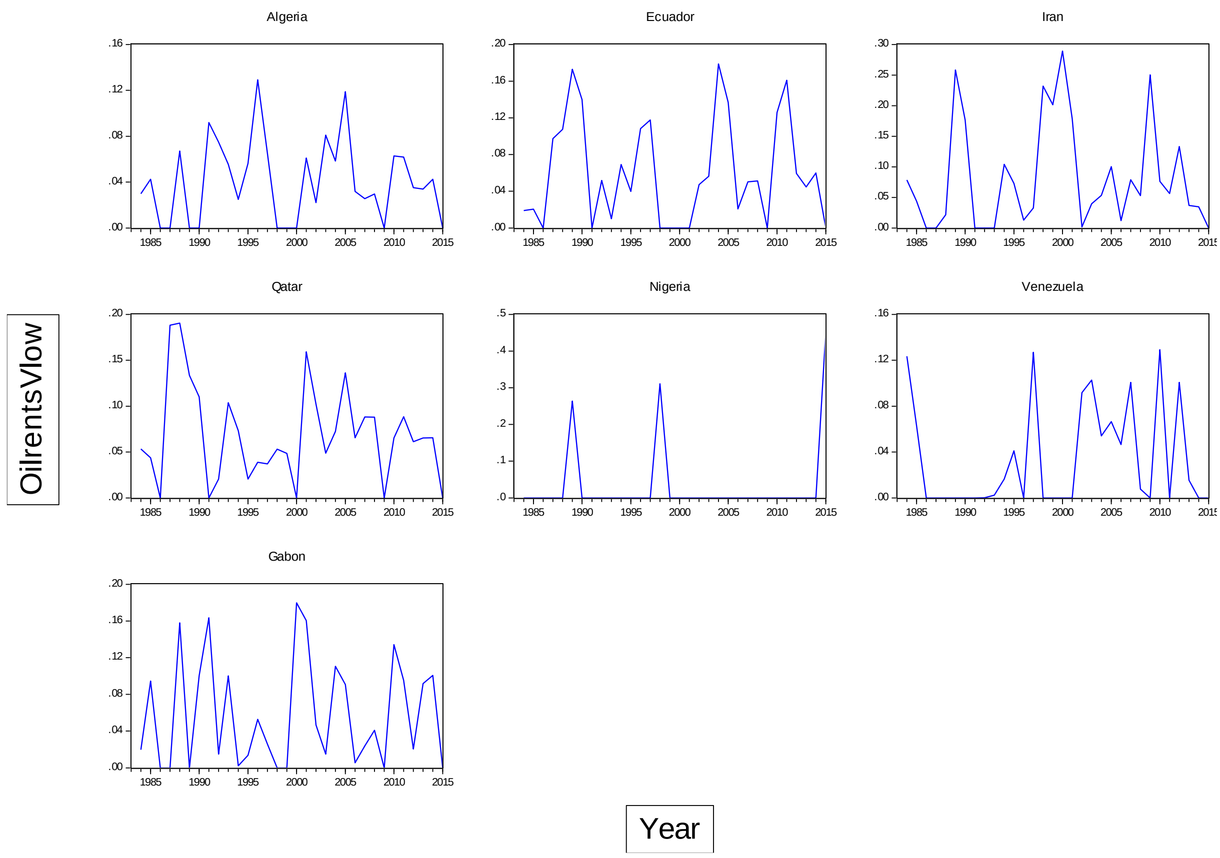
Appendix B.10. Oil revenue low volatility for seven oil exporting non-OPEC countries



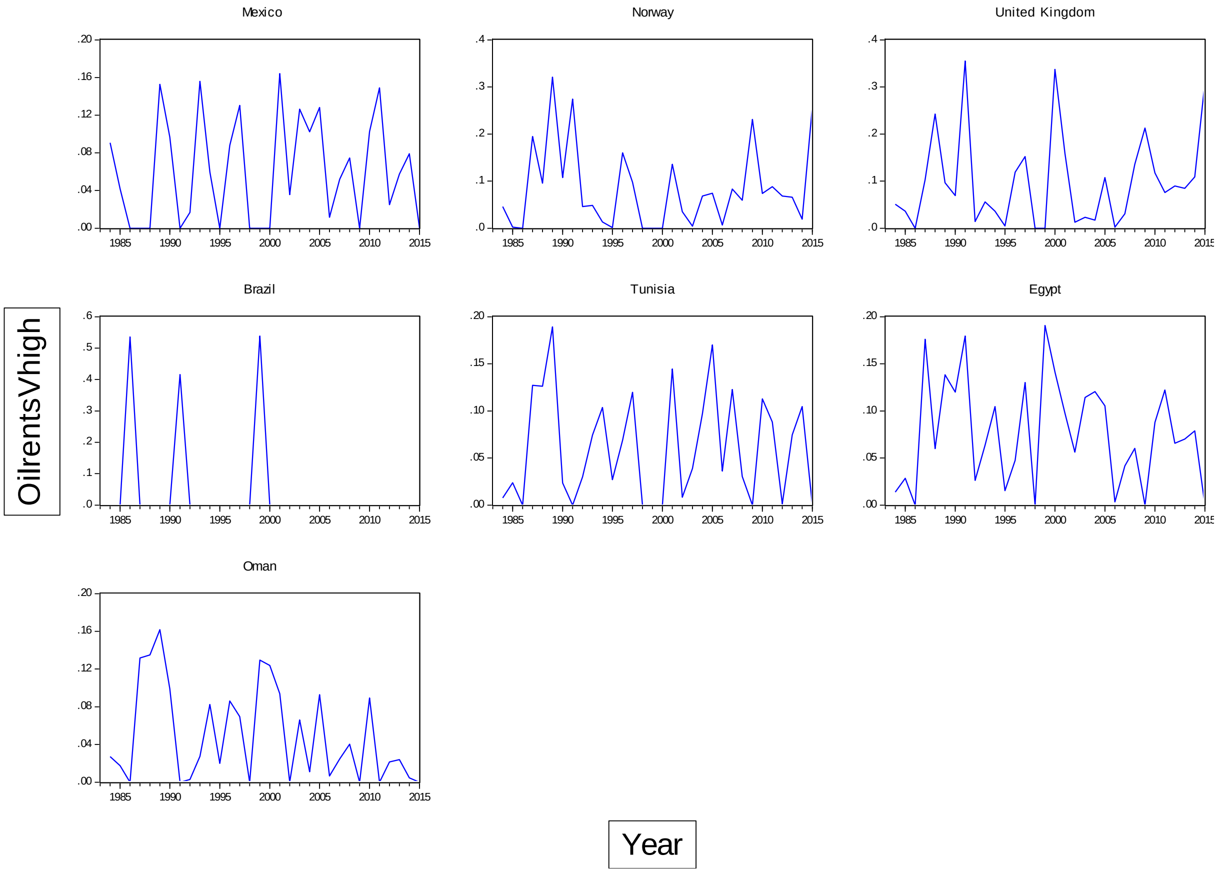
Appendix B.11. Oil rents high volatility for seven oil exporting OPEC countries



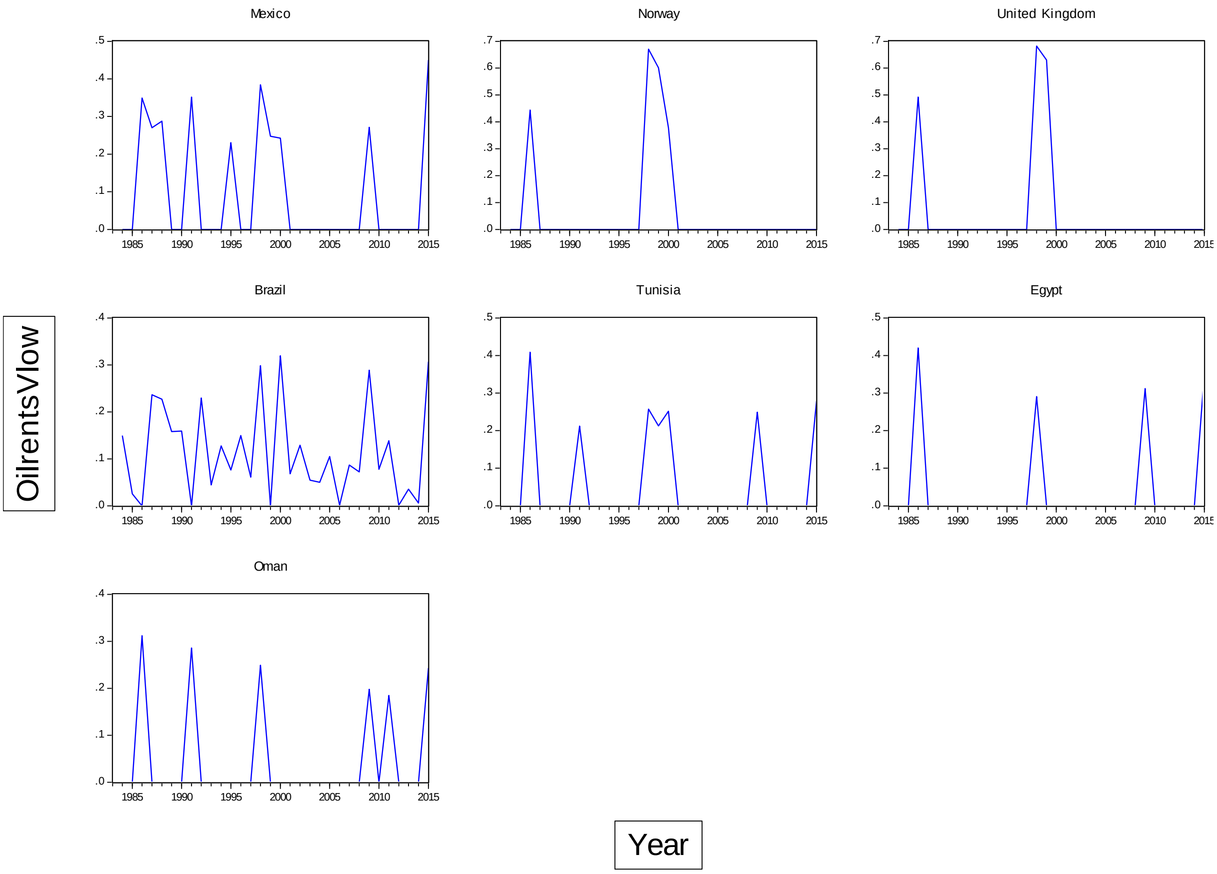
Appendix B.12. Oil rents low volatility for seven oil exporting OPEC countries



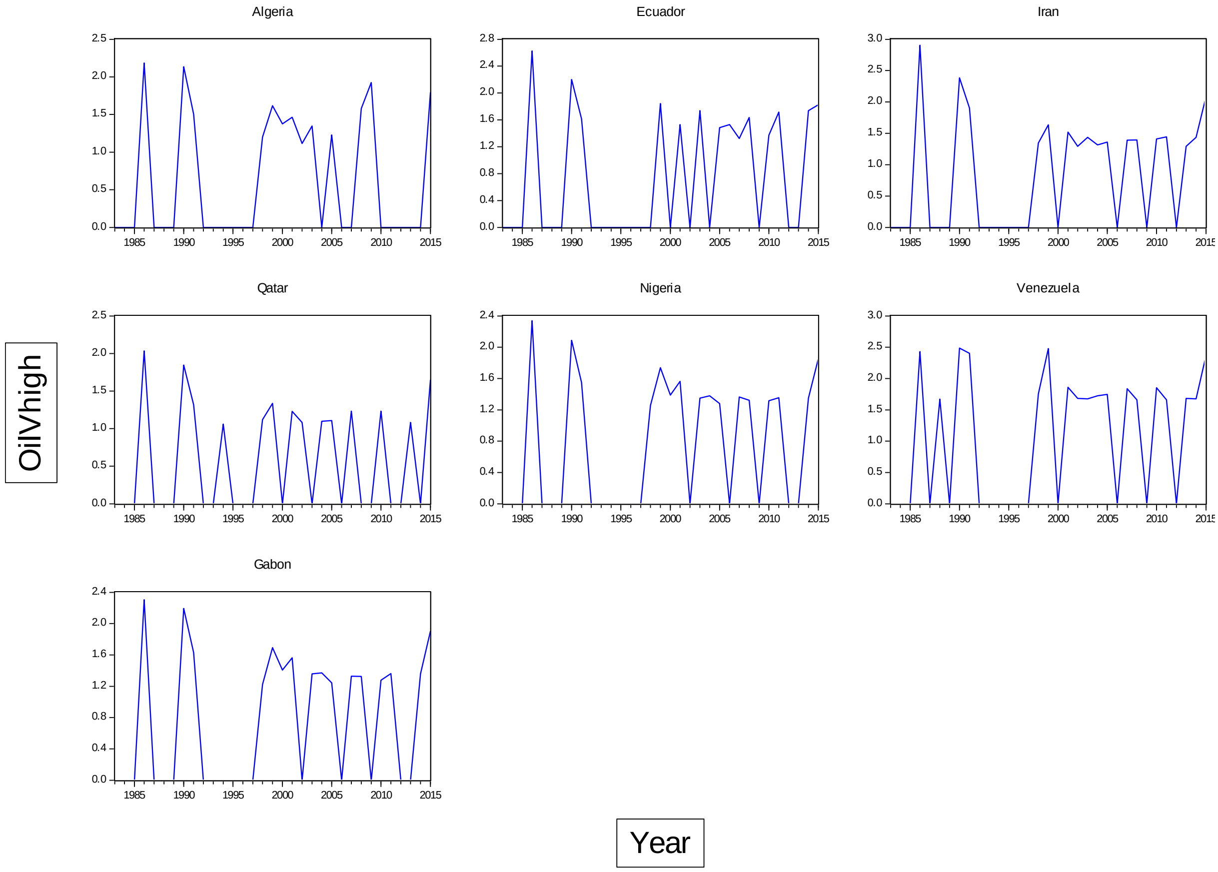
Appendix B.13. Oil rent high volatility for seven oil exporting non-OPEC countries



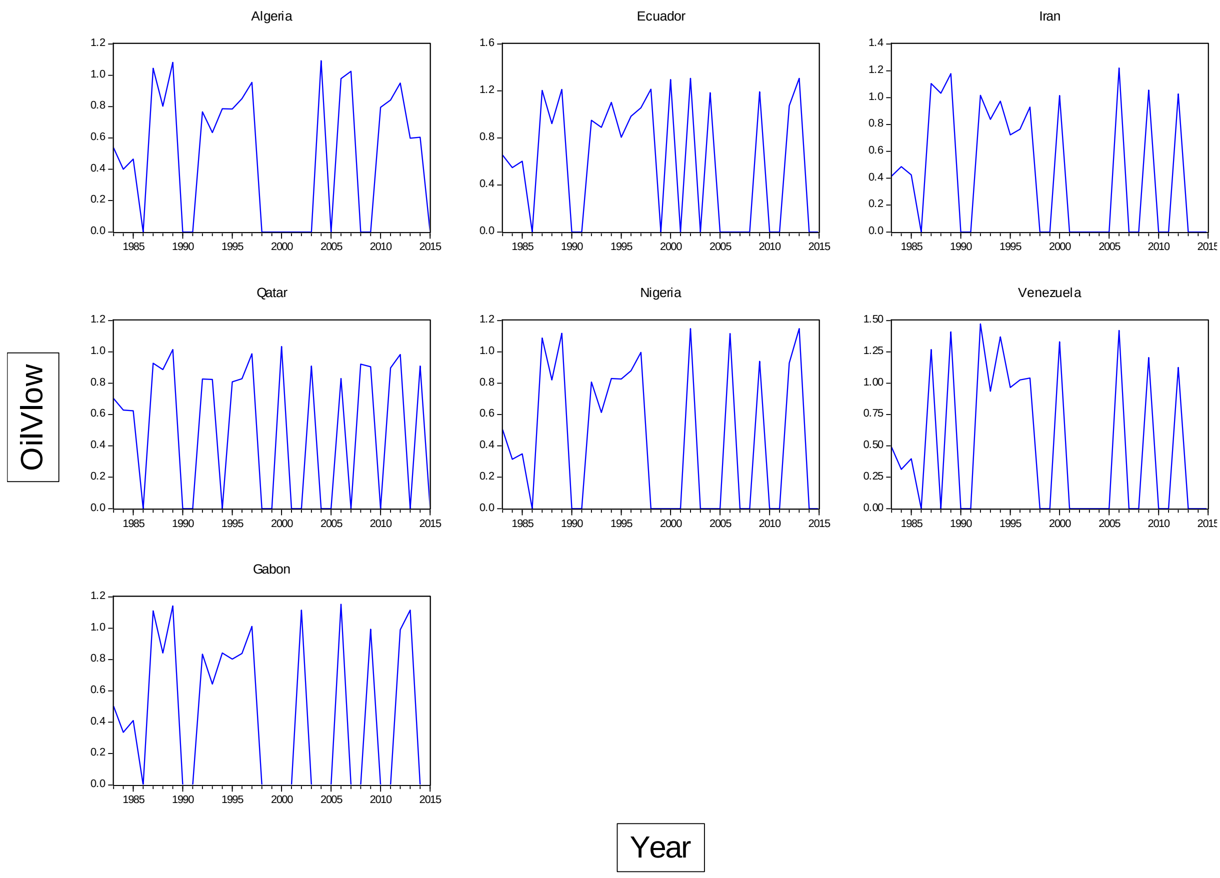
Appendix B.14. Oil rent low volatility for seven oil exporting non-OPEC countries



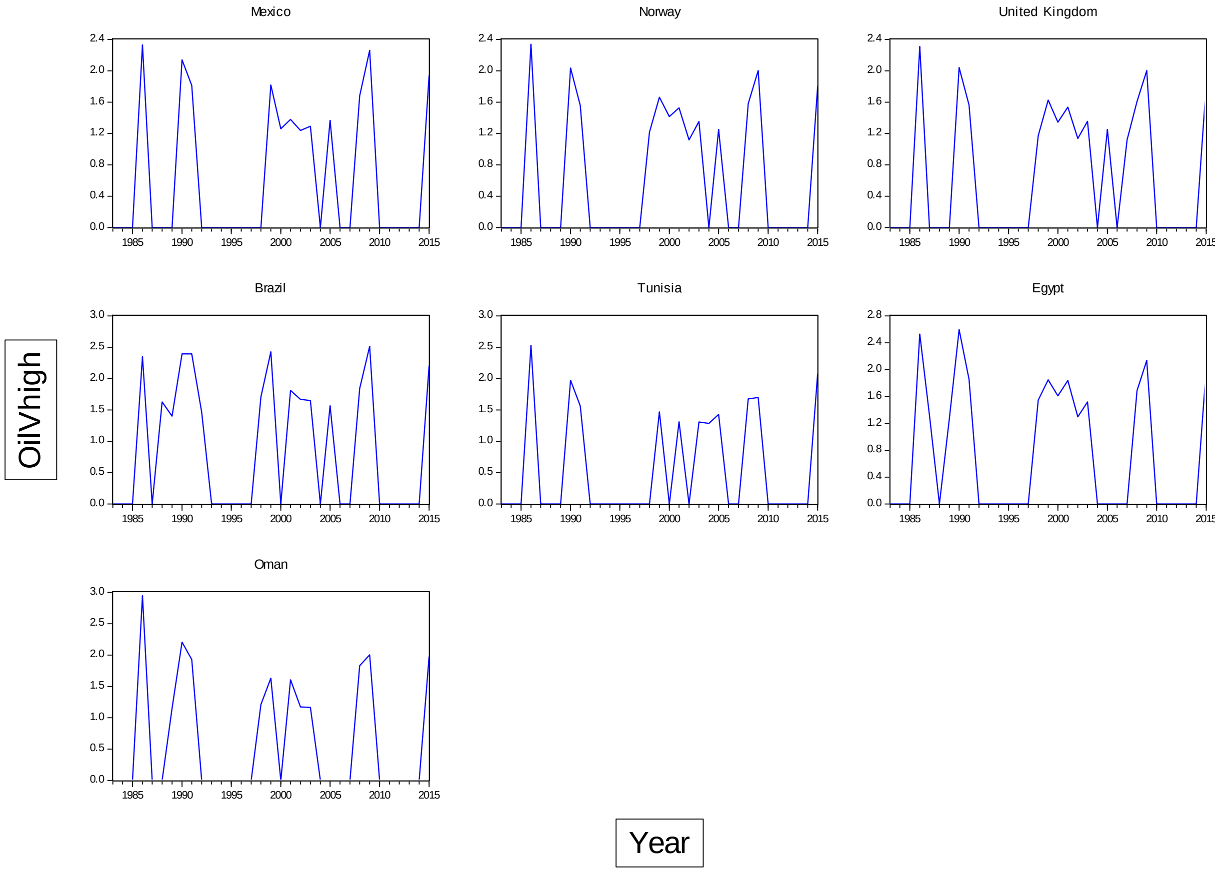
Appendix B.15. Oil price high volatility for seven oil exporting OPEC countries



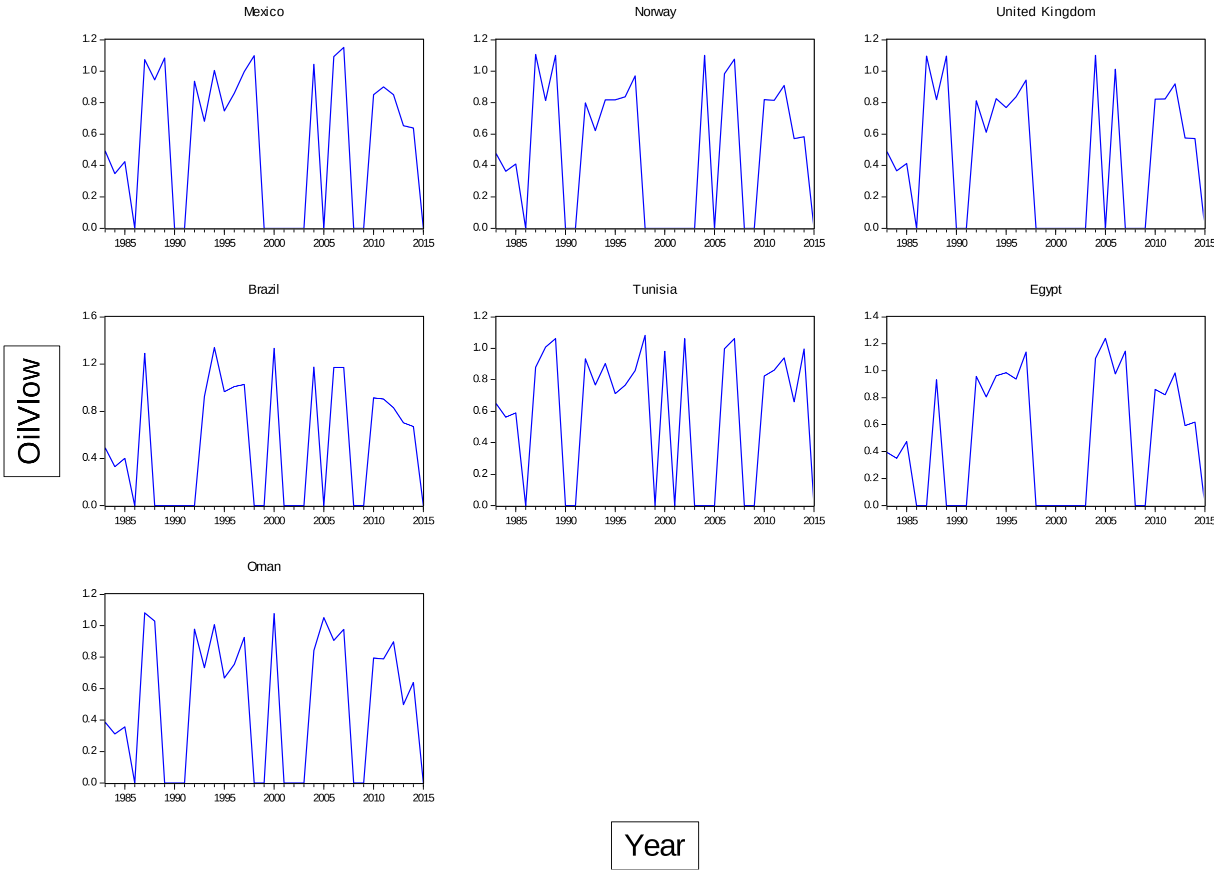
Appendix B.16. Oil price low volatility for seven oil exporting OPEC countries



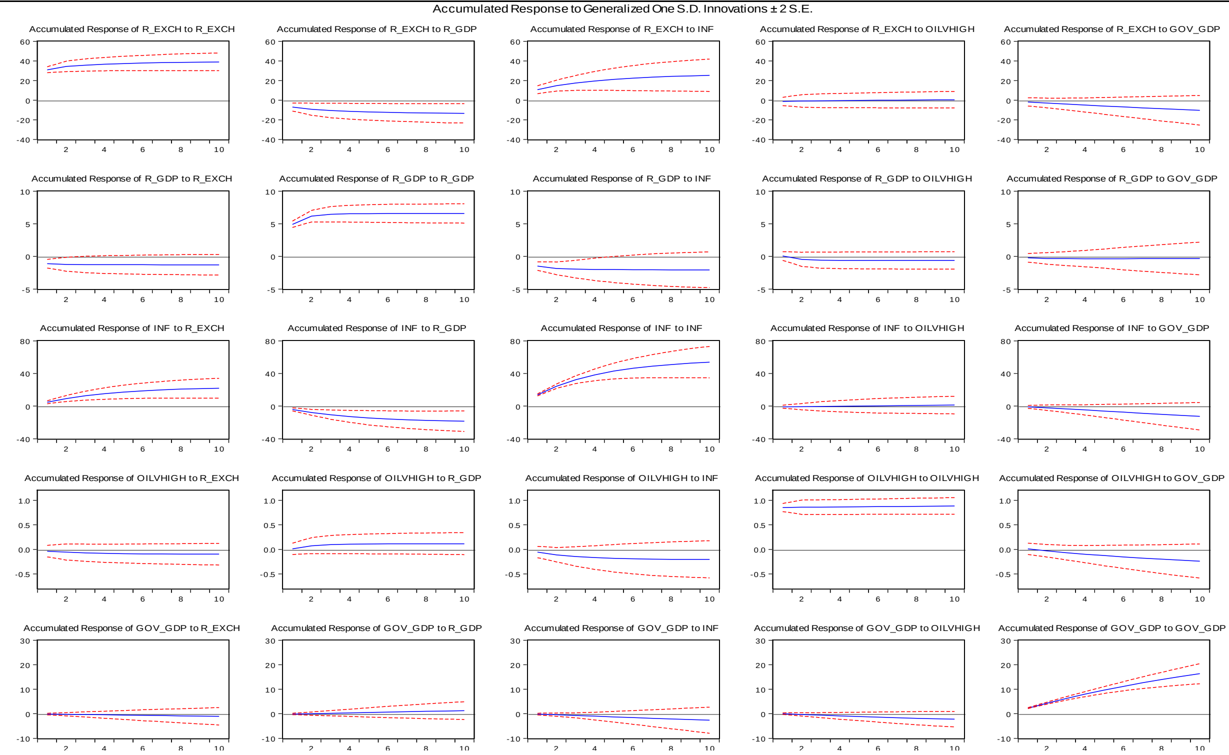
Appendix B.17. Oil price high volatility for seven oil exporting non-OPEC countries



Appendix B.18. Oil price Low volatility for seven oil exporting non-OPEC countries

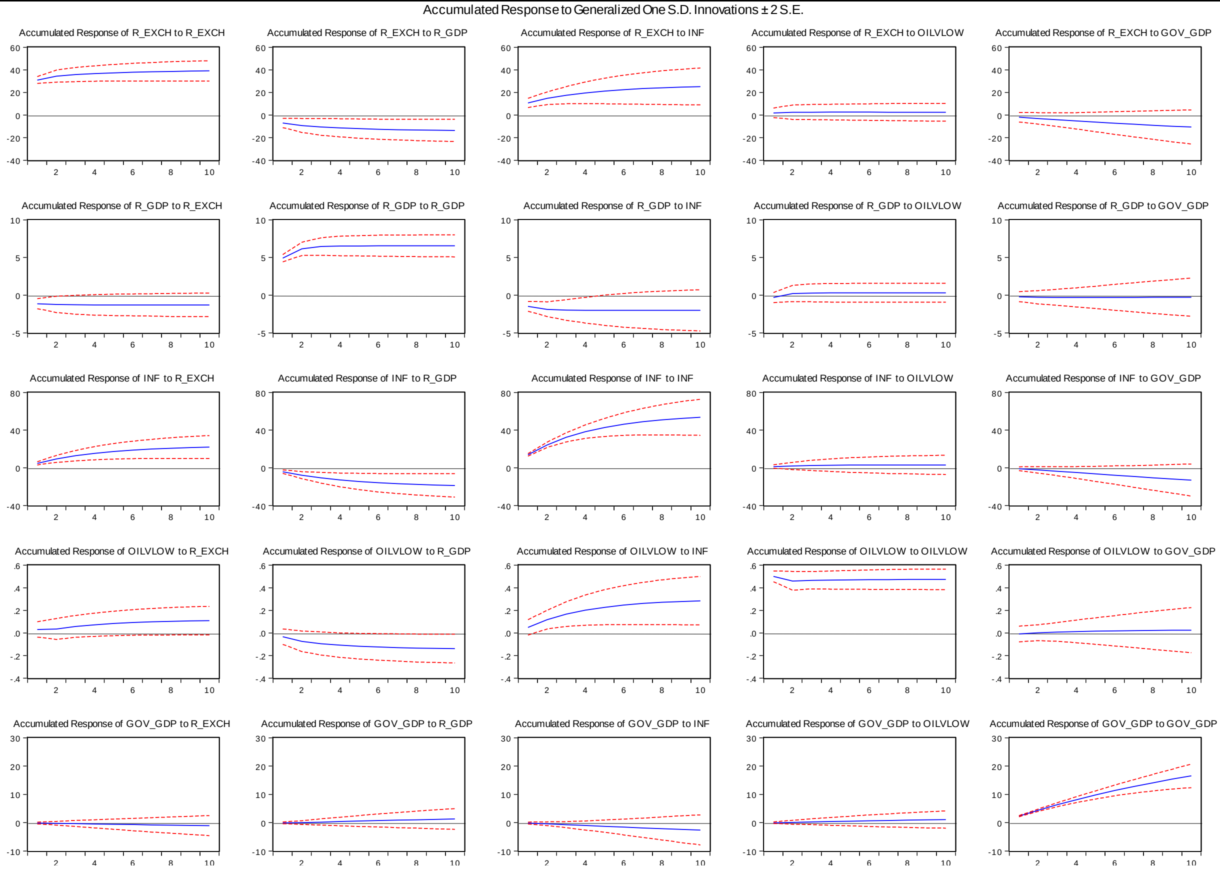


Appendix B.19. Cumulative generalised impulse responses of oil price high volatility in OPEC countries



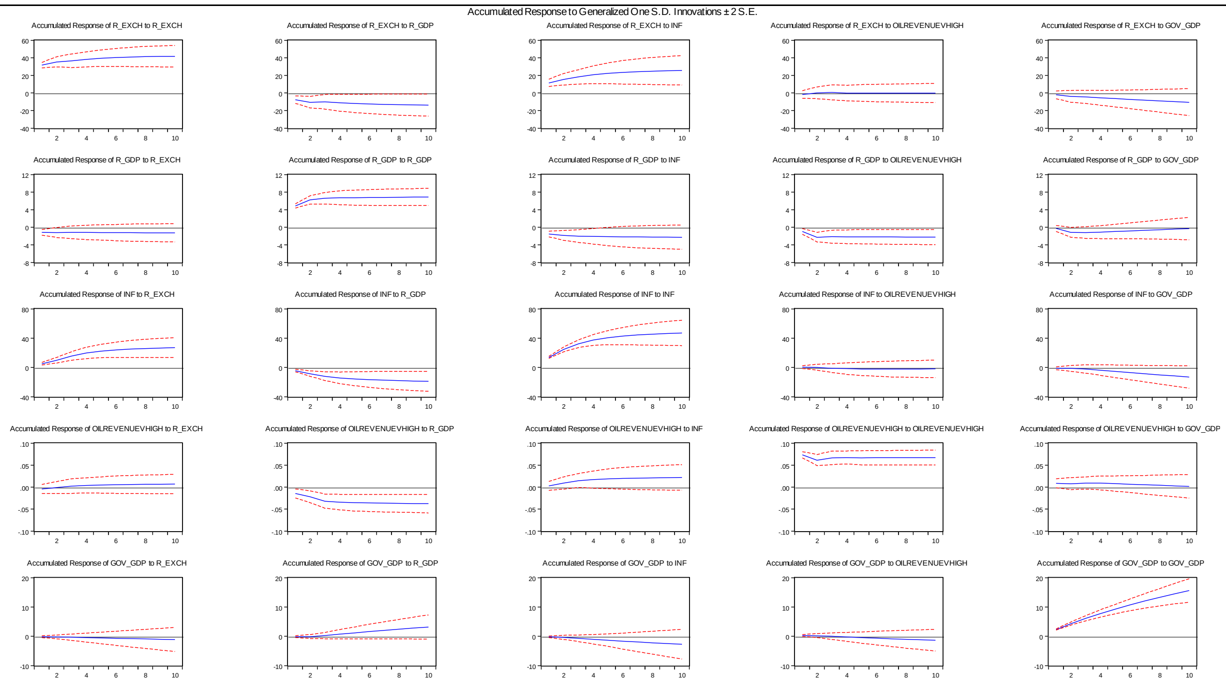
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, GOV_EXP= government spending

Appendix B.20. Cumulative generalised impulse responses of oil price low volatility in OPEC countries



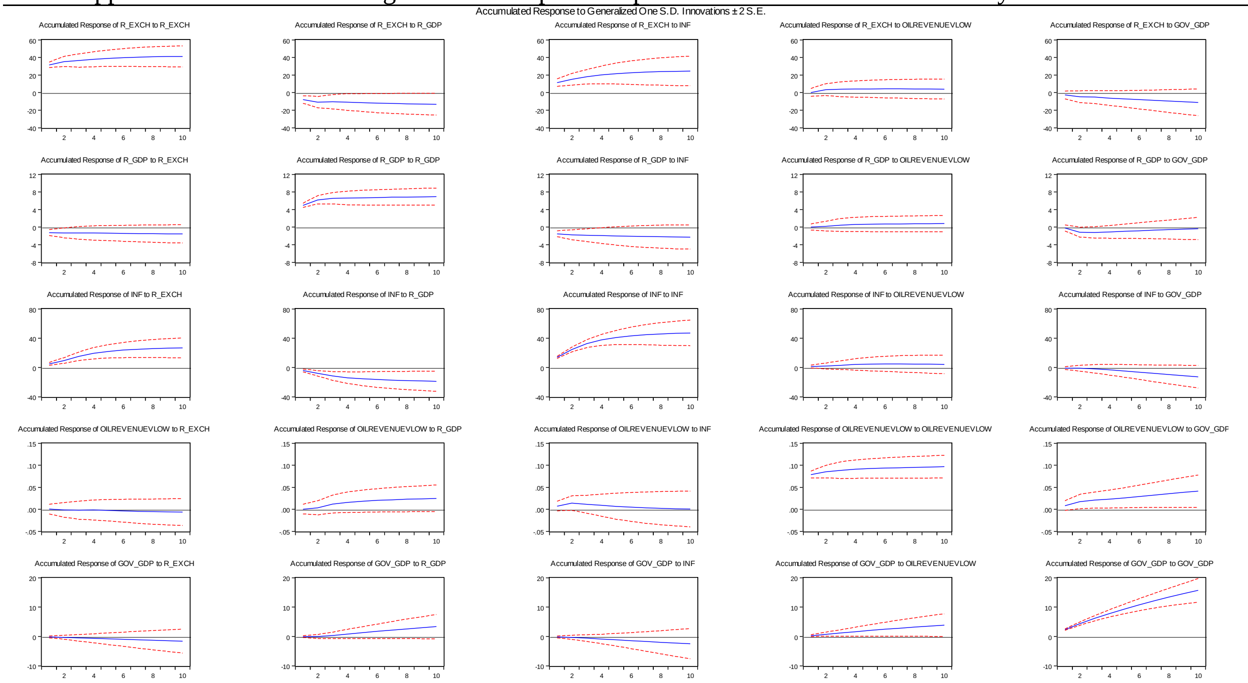
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, GOV_EXP= government spending

Appendix B.21. Cumulative generalised impulse responses of oil revenue high volatility in OPEC countries



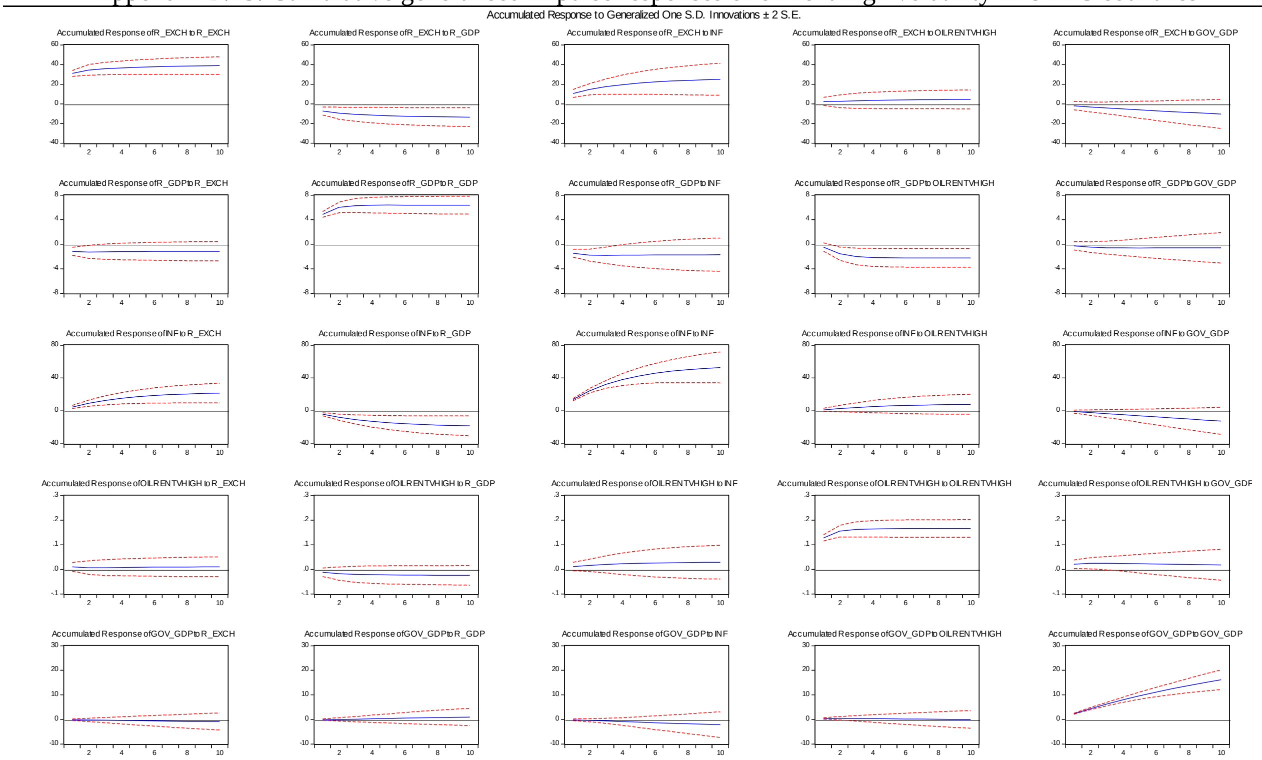
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, GOV_EXP= government spending

Appendix B.22. Cumulative generalised impulse responses of oil revenue low volatility in OPEC countries



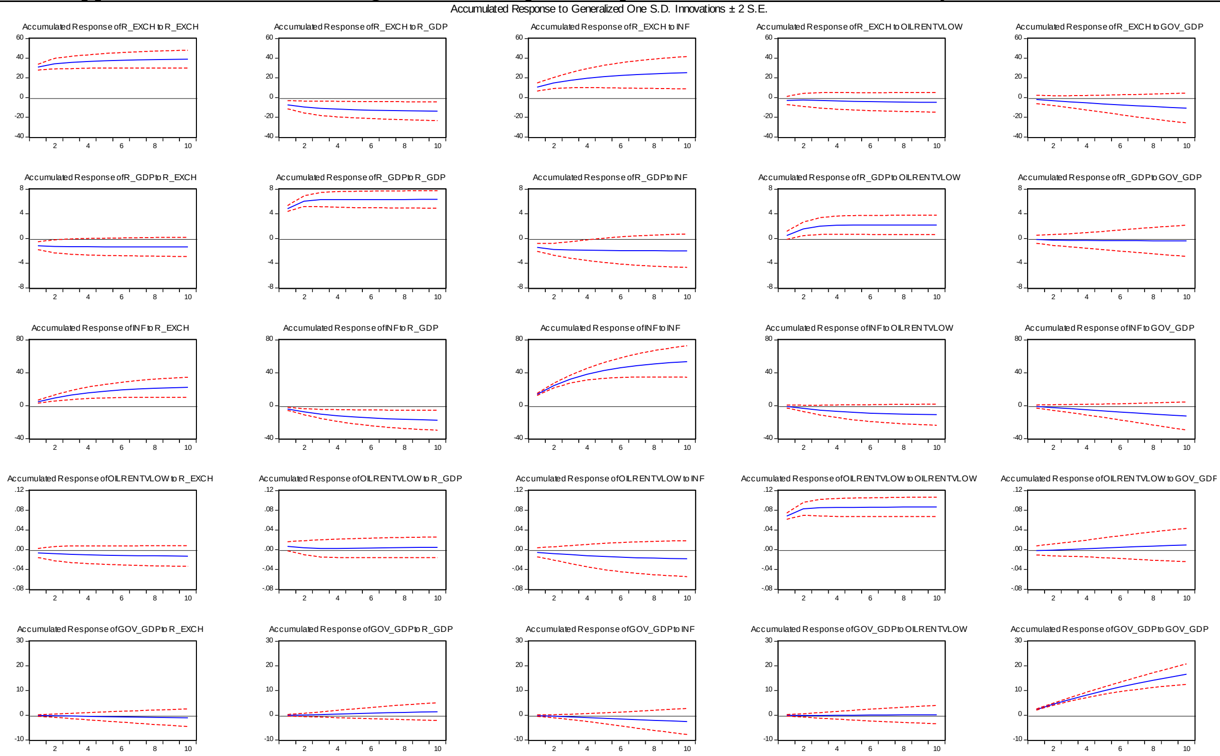
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, GOV_EXP= government spending

Appendix B.23. Cumulative generalised impulse responses of oil rent high volatility in OPEC countries



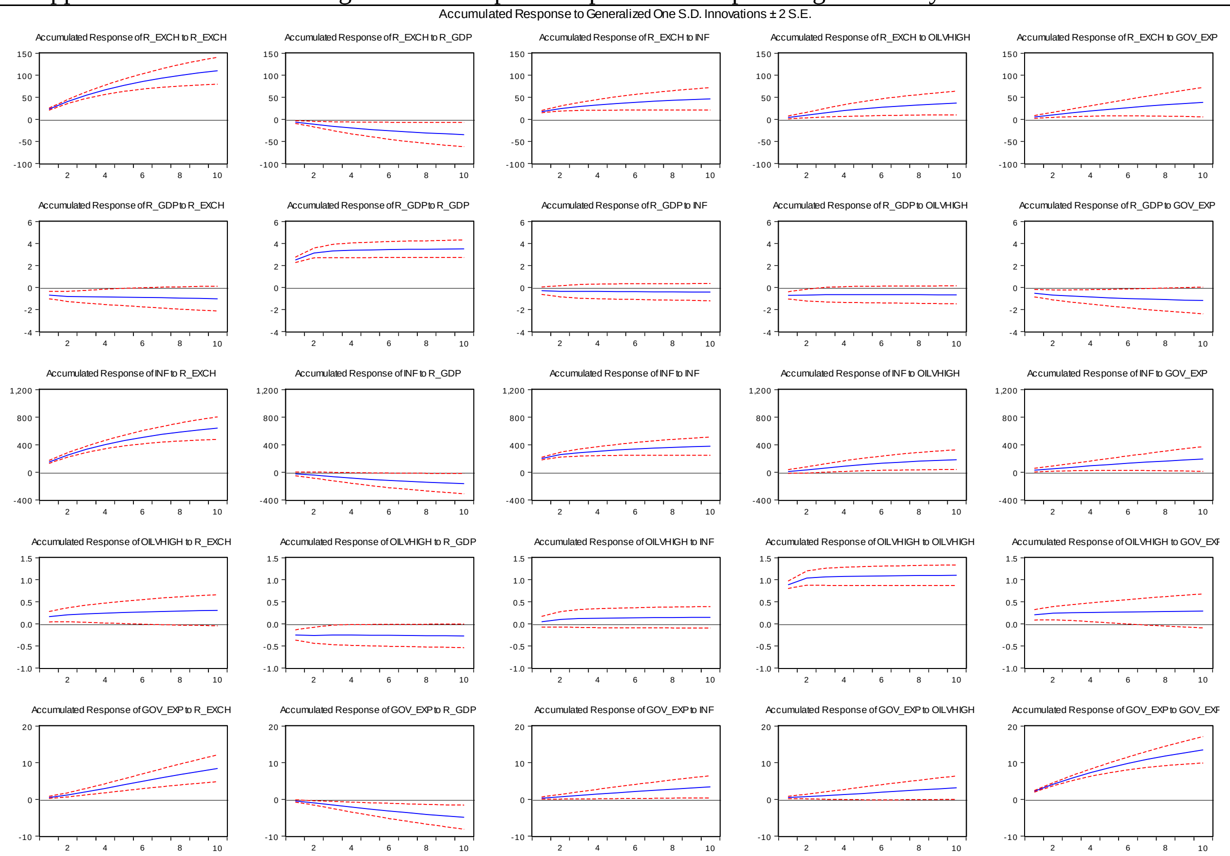
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTVHIGH= oil rent high volatility, GOV_EXP= government spending

Appendix B.24. Cumulative generalised impulse responses of oil rent low volatility in OPEC countries



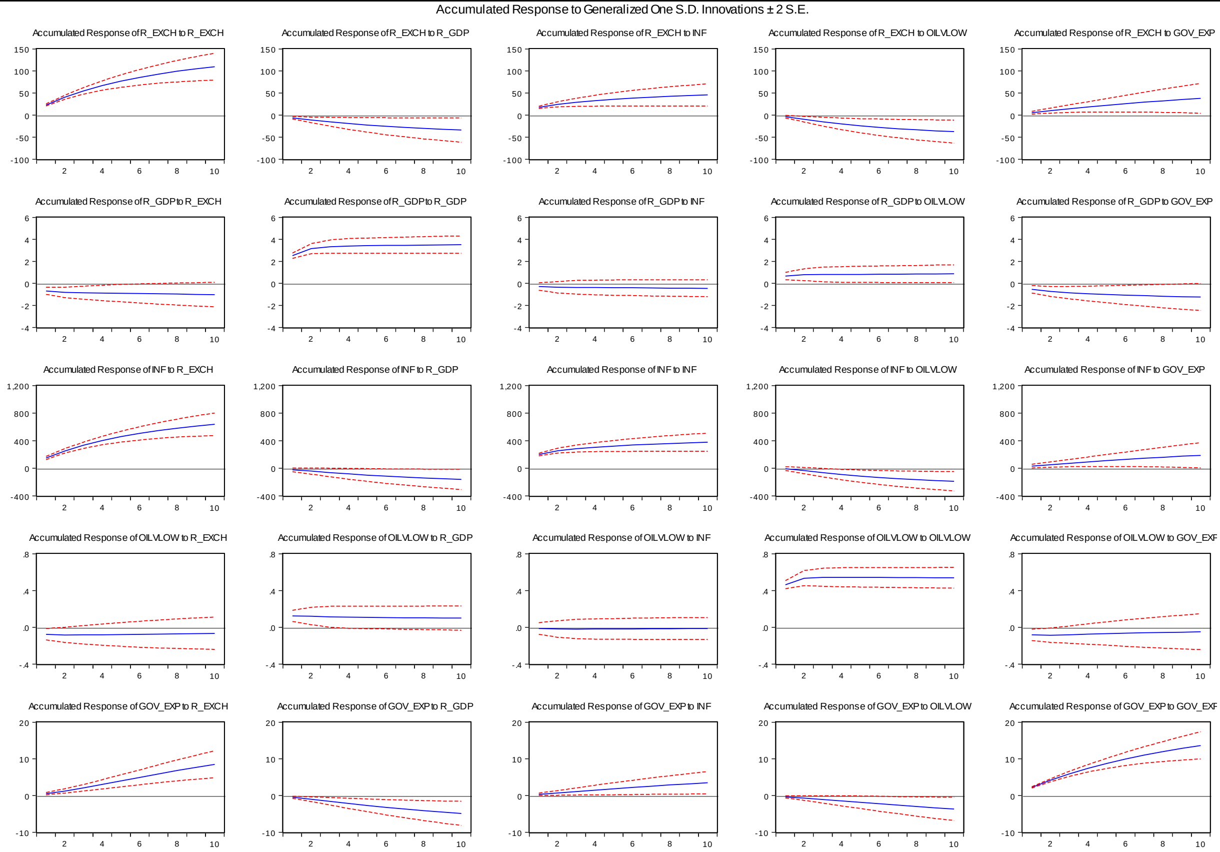
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTVLOW= oil rent low volatility, GOV_EXP= government spending

Appendix B.25. Cumulative generalised impulse responses of oil price high volatility in non-OPEC countries



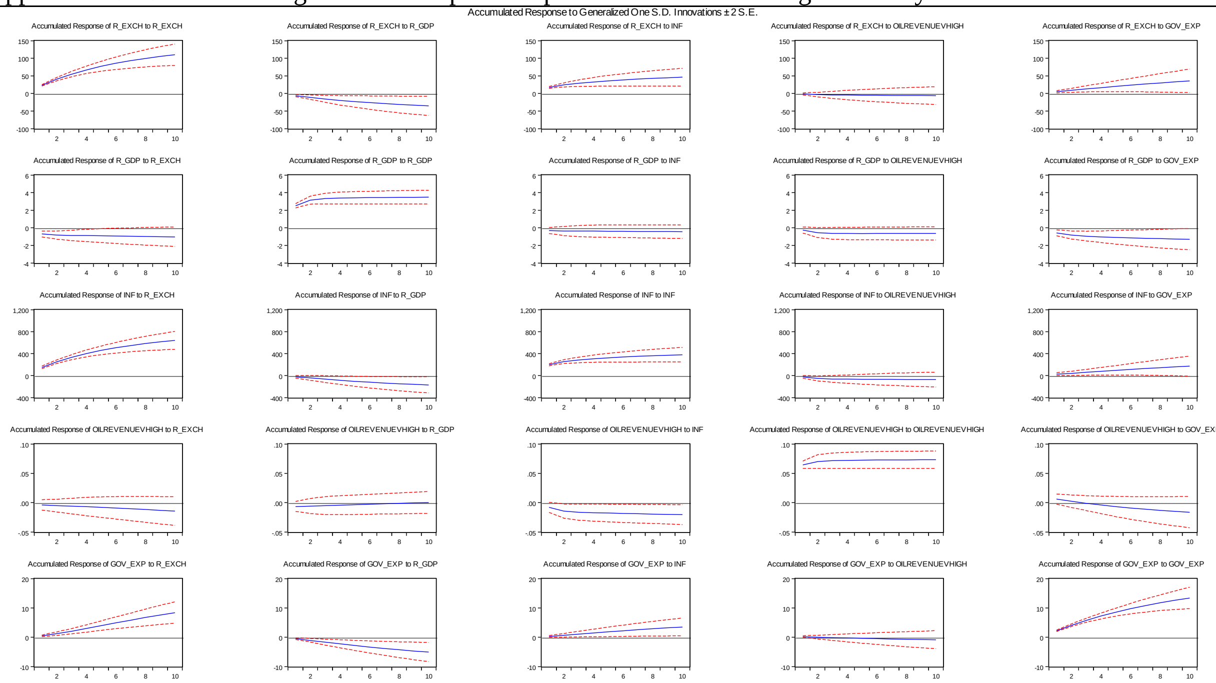
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, GOV_EXP= government spending

Appendix B.26. Cumulative generalised impulse responses of oil price low volatility in non-OPEC countries



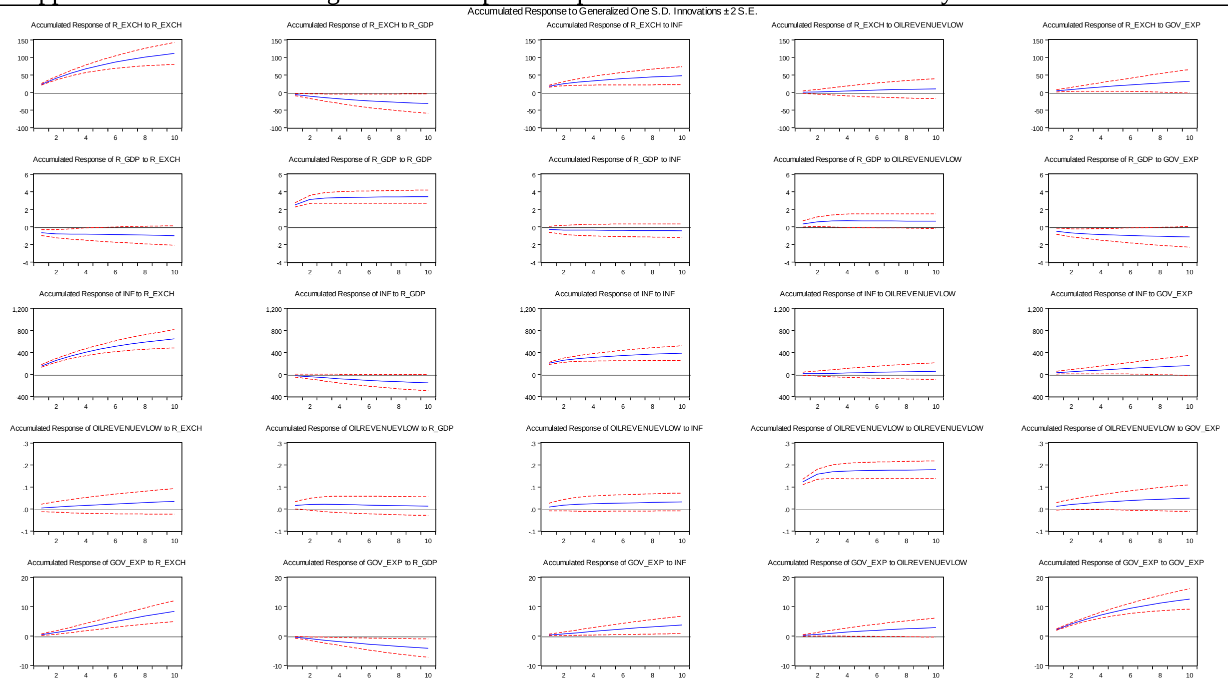
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, GOV_EXP= government spending

Appendix B.27. Cumulative generalised impulse responses of oil revenue high volatility in non-OPEC countries



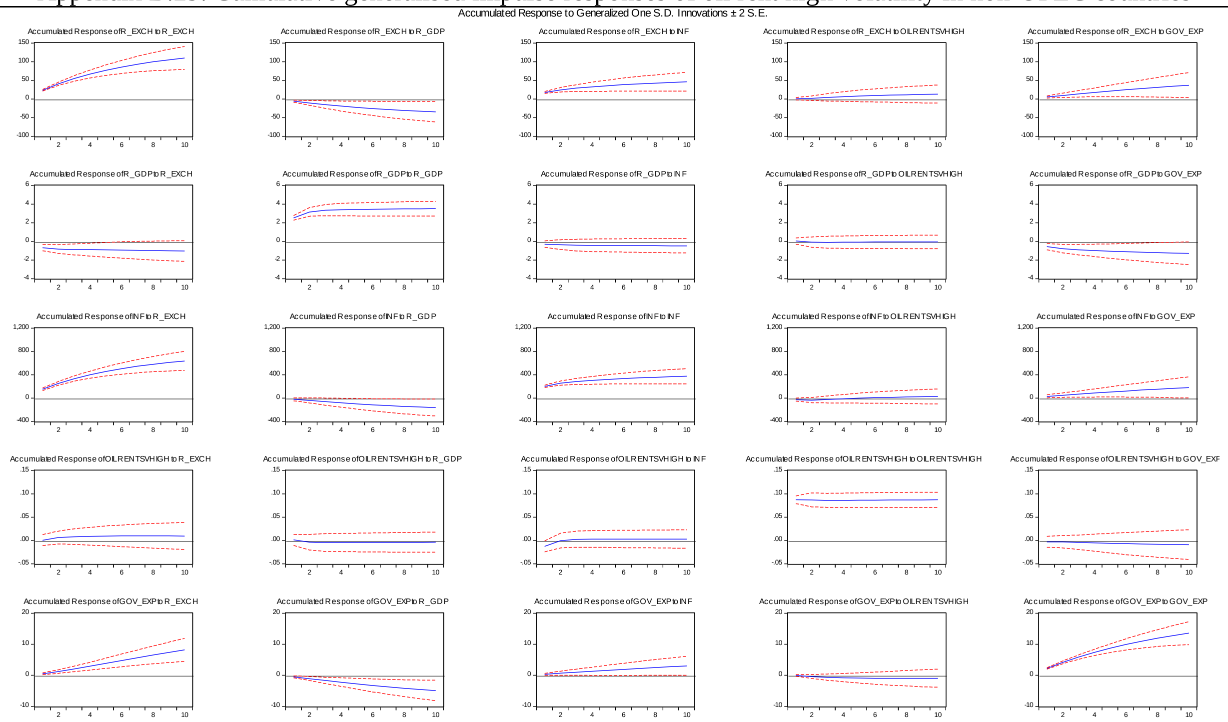
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, GOV_EXP= government spending

Appendix B.28. Cumulative generalised impulse responses of oil revenue low volatility in non-OPEC countries



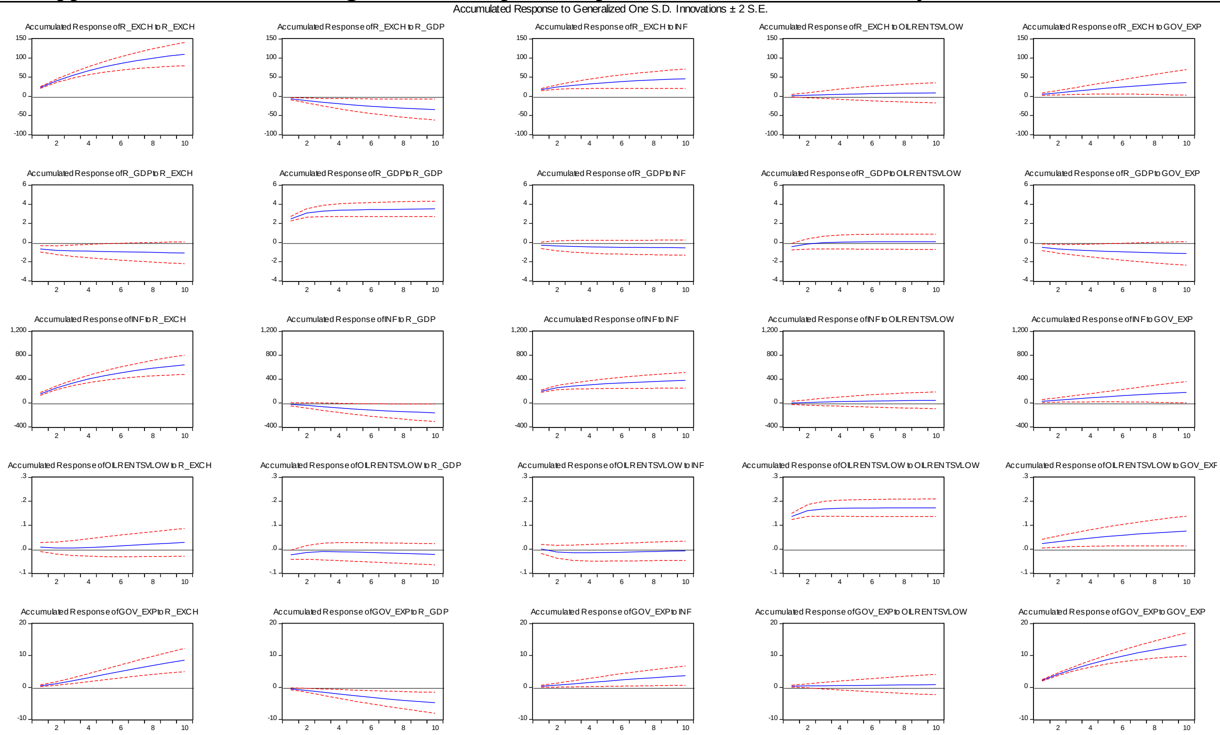
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, GOV_EXP= government spending

Appendix B.29. Cumulative generalised impulse responses of oil rent high volatility in non-OPEC countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTVHIGH= oil rent high volatility, GOV_EXP= government spending

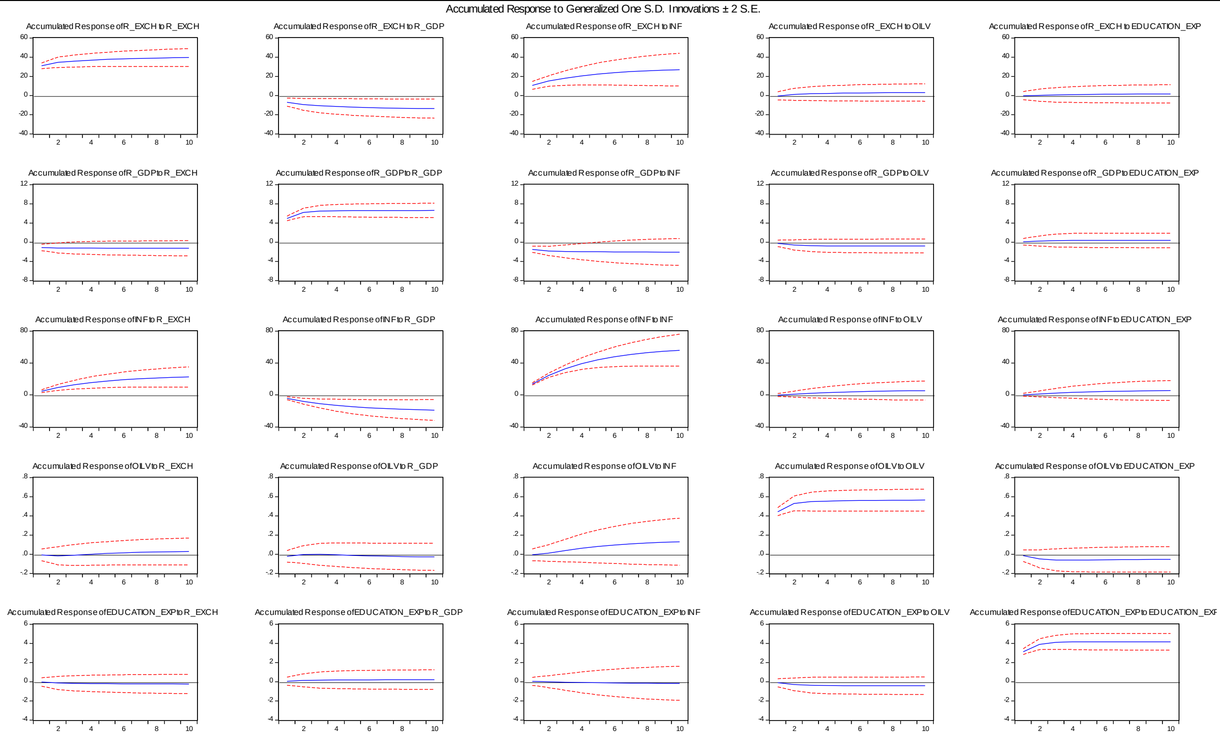
Appendix B.30. Cumulative generalised impulse responses of oil rent low volatility in non-OPEC countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTVLOW= oil rent low volatility, GOV_EXP= government spending

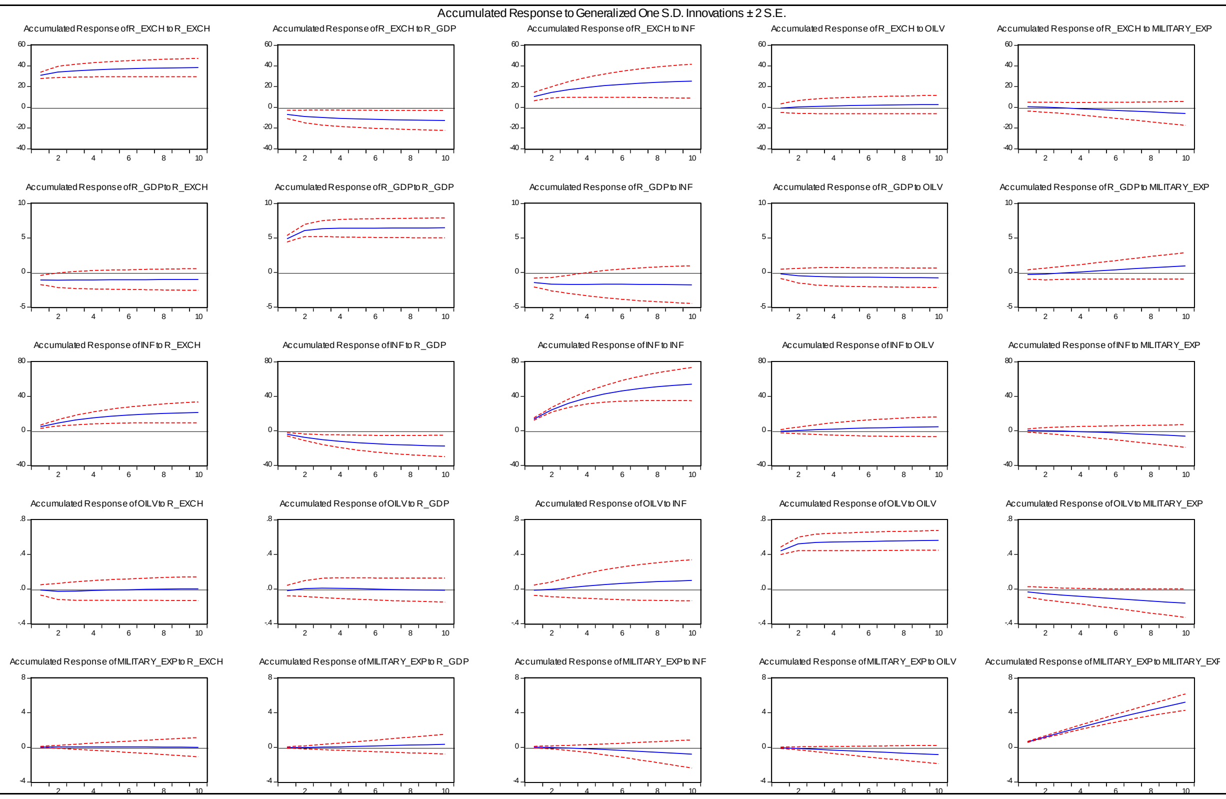
Appendix C: Empirical studies on oil volatility on disaggregated government expenditure

Appendix C.1. Cumulative generalised impulse responses of oil price volatility on education expenditure in OPEC countries



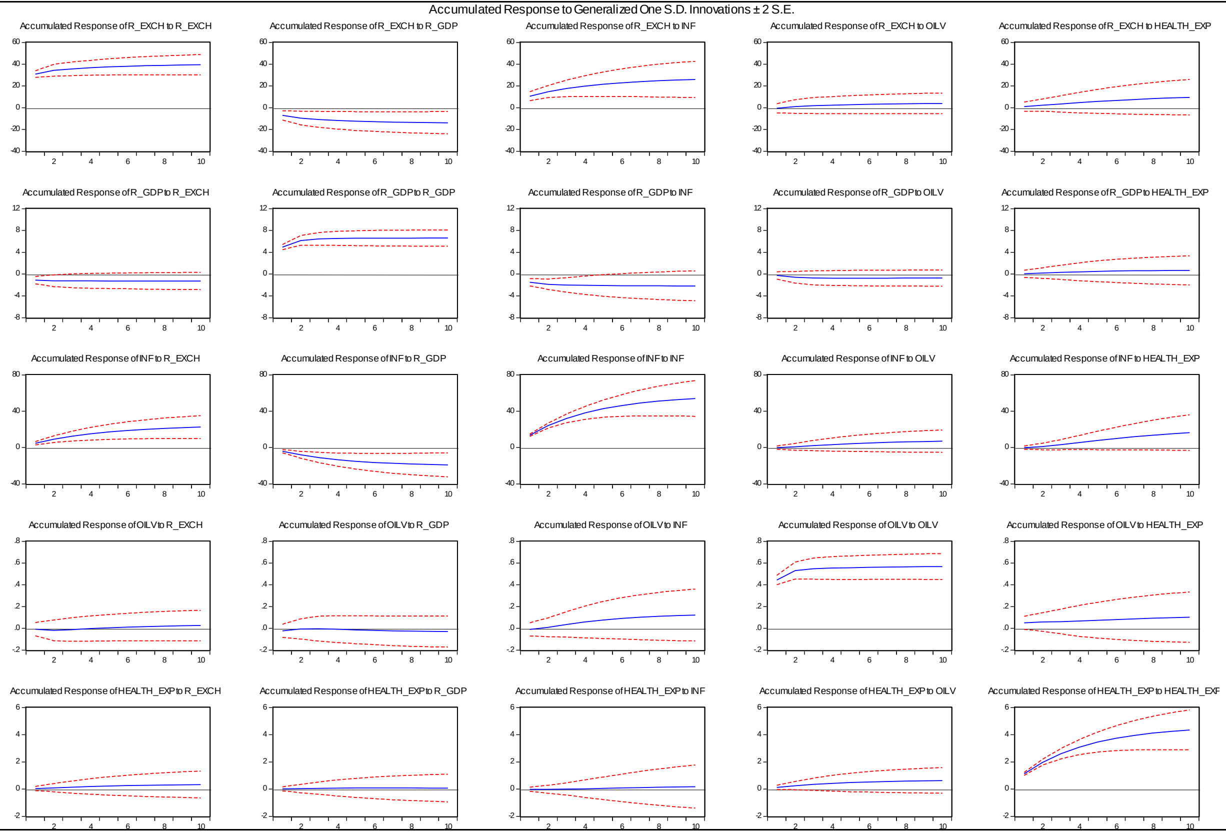
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, EDUCATION_EXP= education expenditure

Appendix C.2. Cumulative generalised impulse responses of oil price volatility on military expenditure in OPEC countries



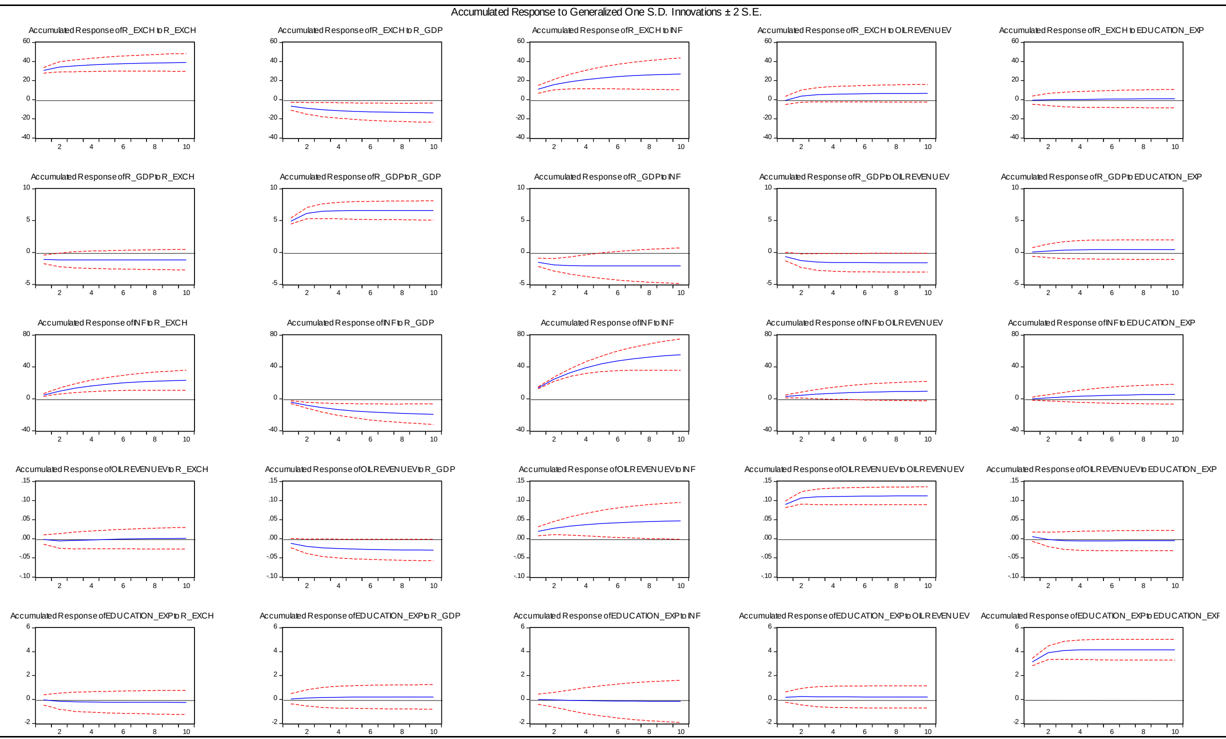
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, MILATARY_EXP= military expenditure

Appendix C.3. Cumulative generalised impulse responses of oil price volatility on health expenditure in OPEC countries



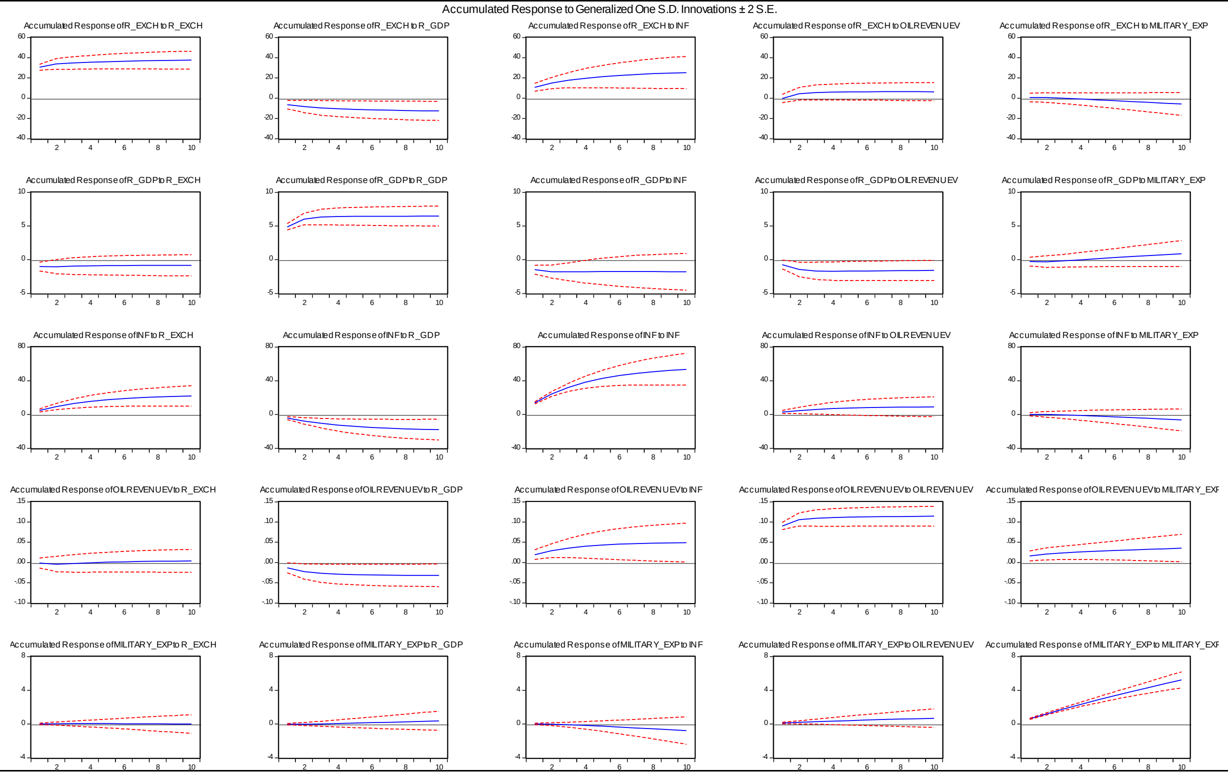
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, HEALTH_EXP= health expenditure

Appendix C.4. Cumulative generalised impulse responses of oil revenue volatility on education expenditure in OPEC countries



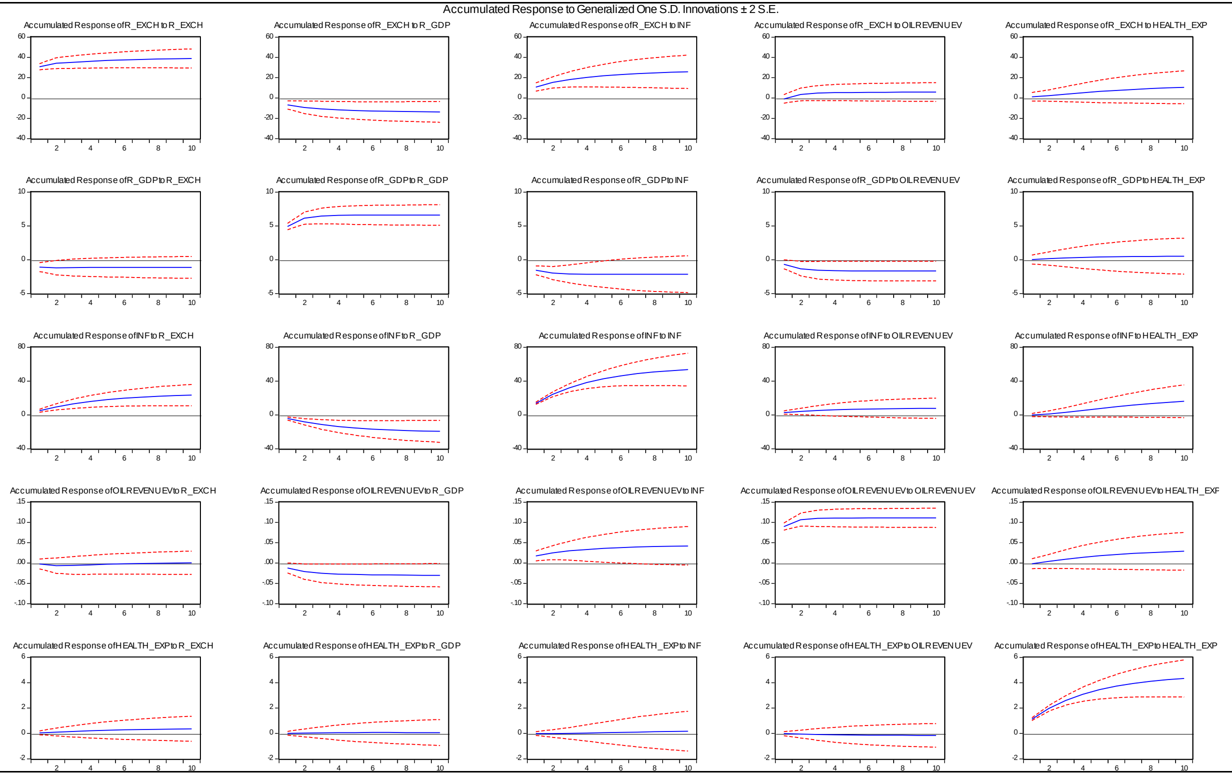
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, EDUCATION_EXP= education expenditure

Appendix C.5. Cumulative generalised impulse responses of oil revenue volatility on military expenditure in OPEC countries



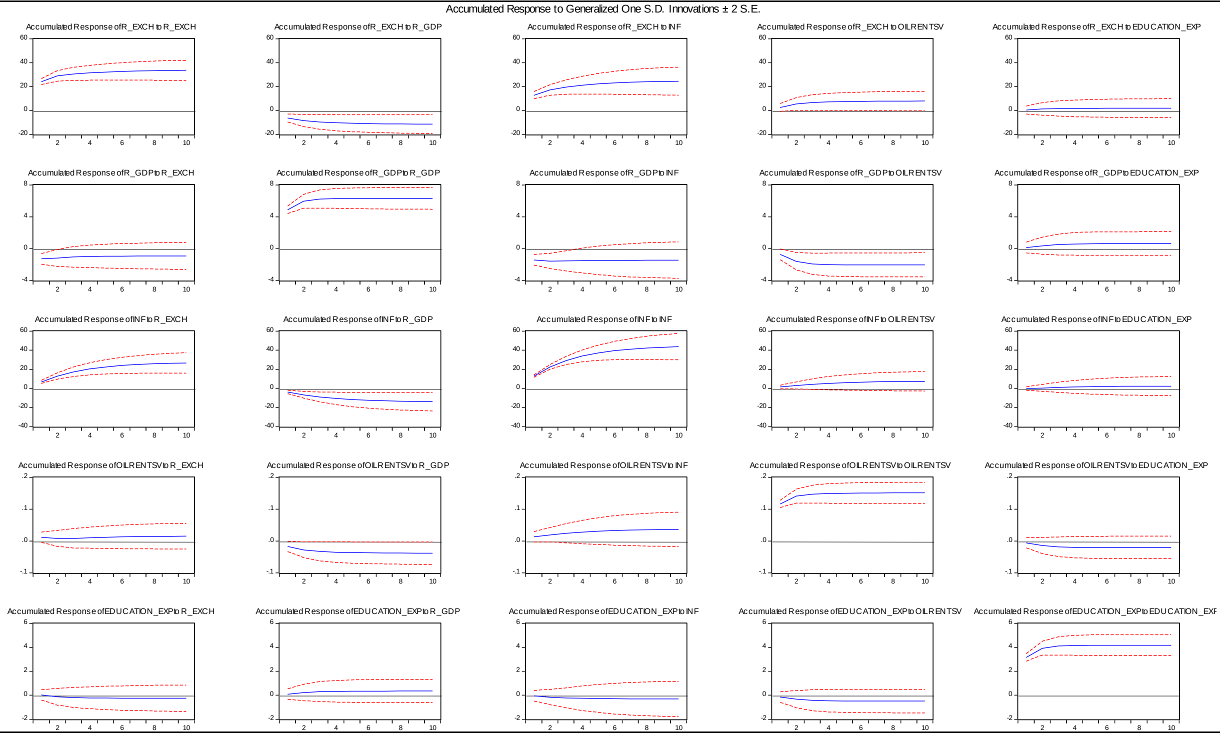
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEV= oil revenue volatility, MILATARY_EXP= military expenditure

Appendix C.6. Cumulative generalised impulse responses of oil revenue volatility on health expenditure in OPEC countries



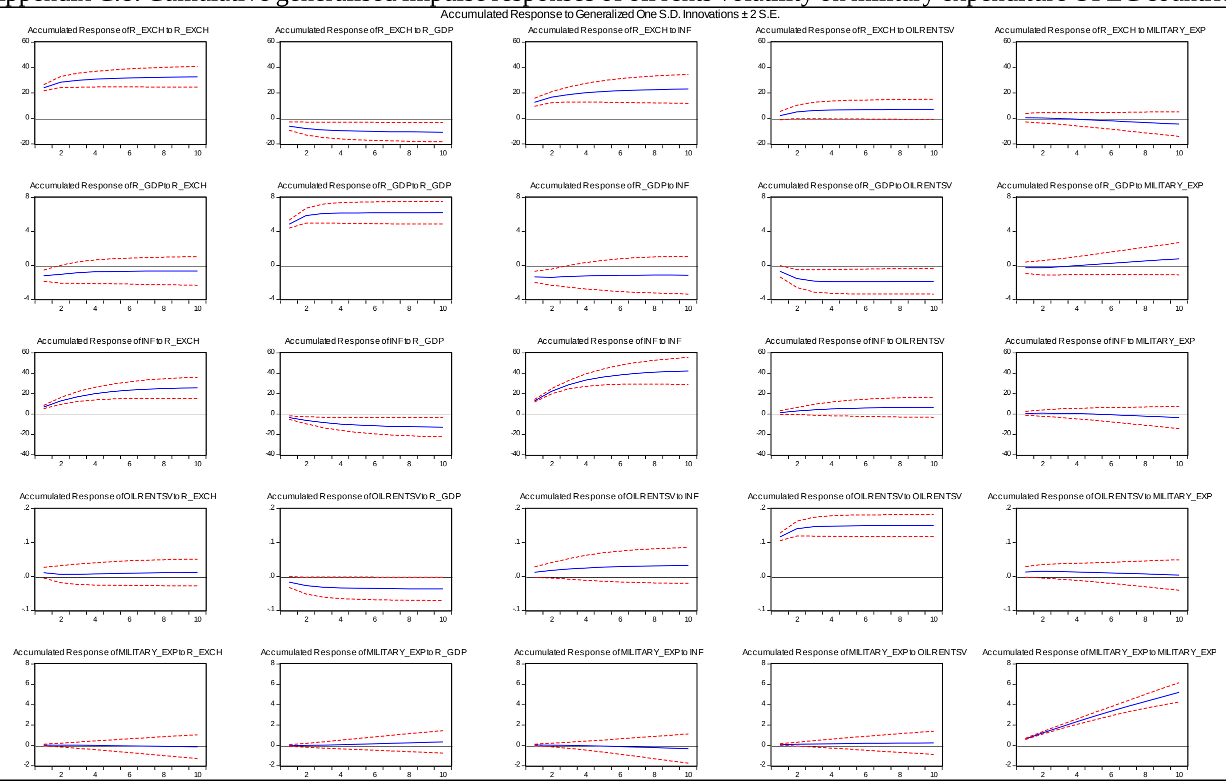
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEV= oil revenue volatility, HEALTH_EXP= health expenditure

Appendix C.7. Cumulative generalised impulse responses of oil rents volatility on education expenditure OPEC countries



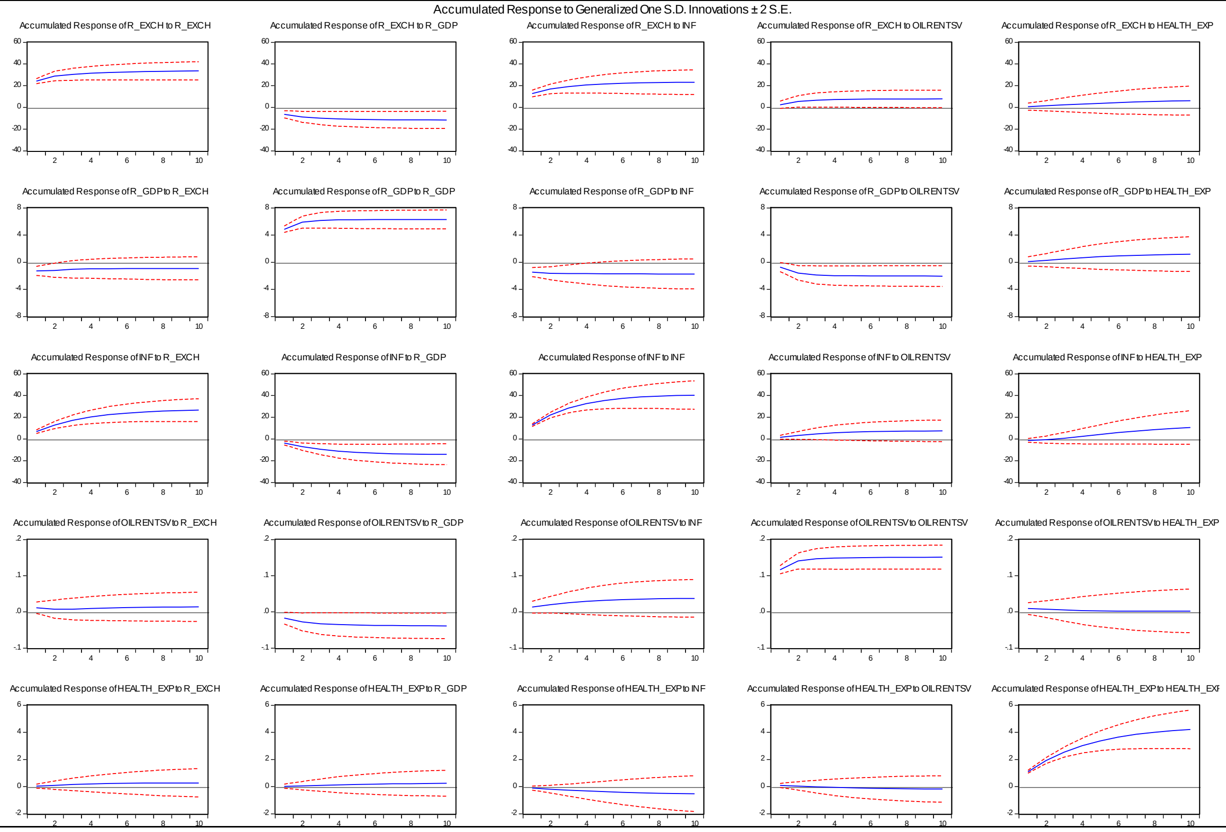
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, EDUCATION_EXP= education expenditure

Appendix C.8. Cumulative generalised impulse responses of oil rents volatility on military expenditure OPEC countries



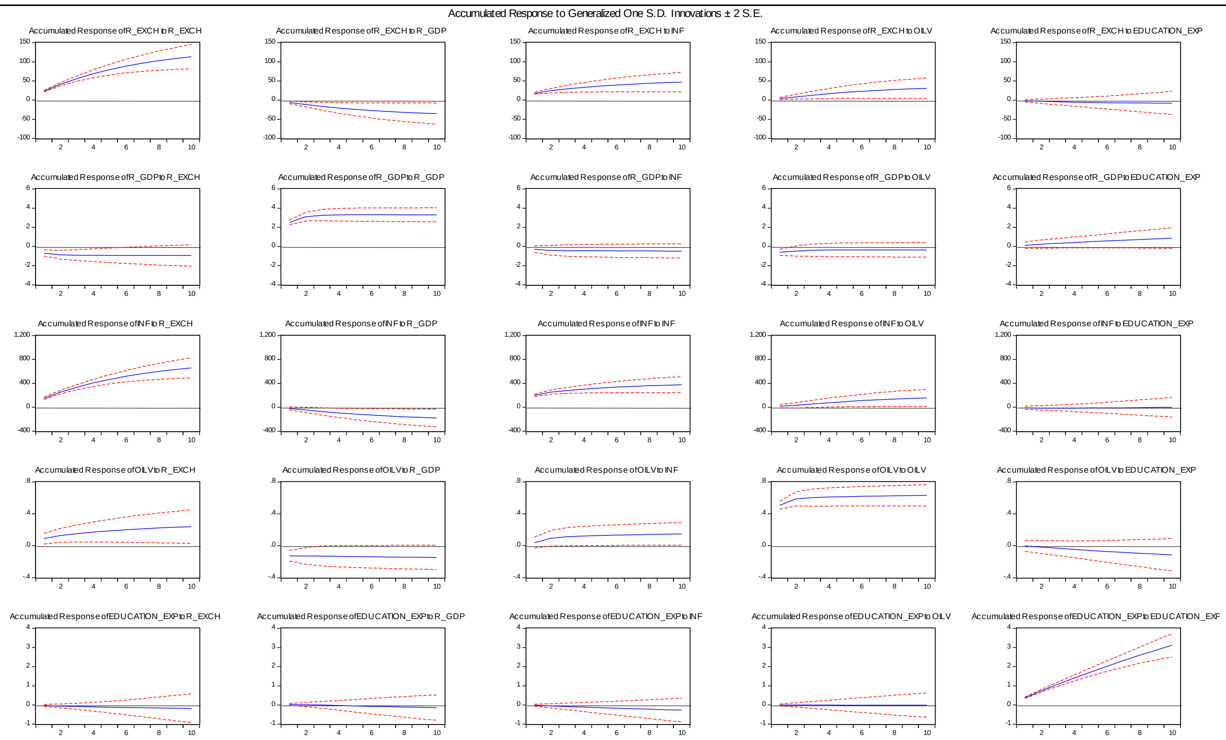
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, MILITARY_EXP= military expenditure

Appendix C.9. Cumulative generalised impulse responses of oil rents volatility on health expenditure OPEC countries



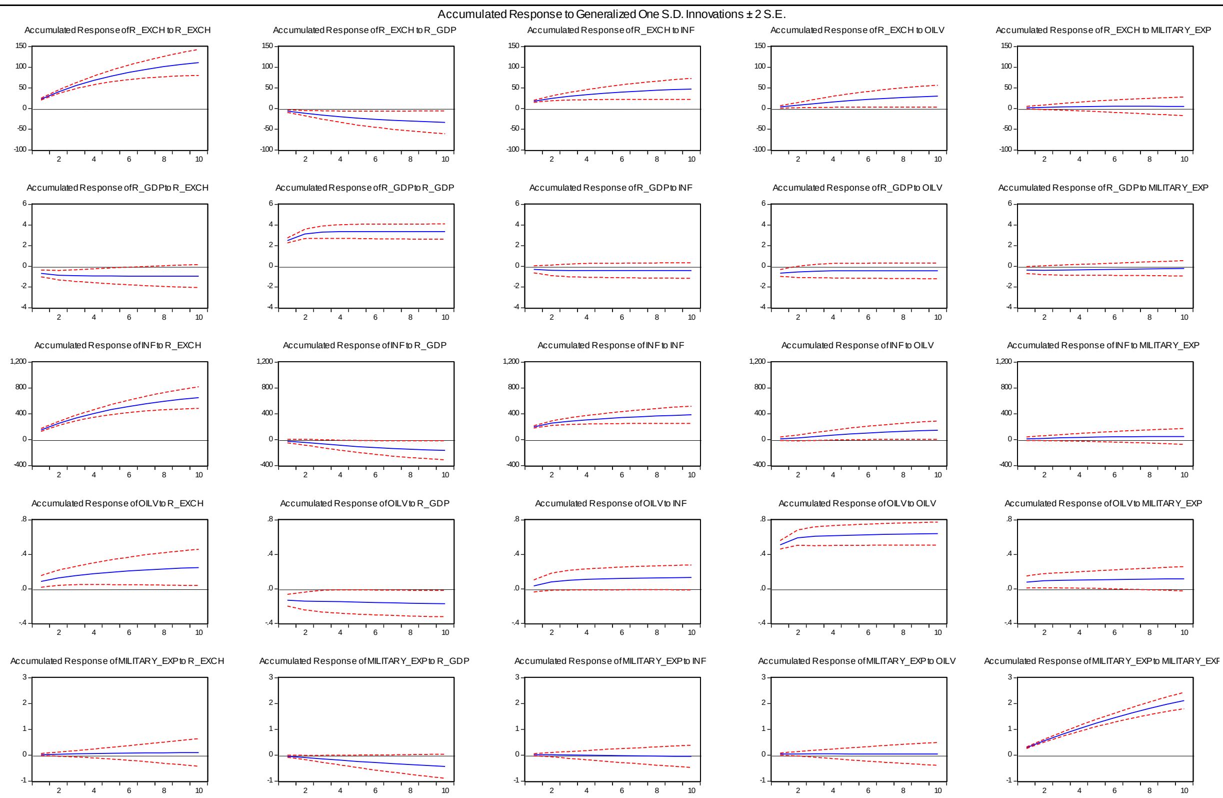
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, HEALTH_EXP= health expenditure

Appendix C.10. Cumulative generalised impulse responses of oil price volatility on education expenditure in non-OPEC countries



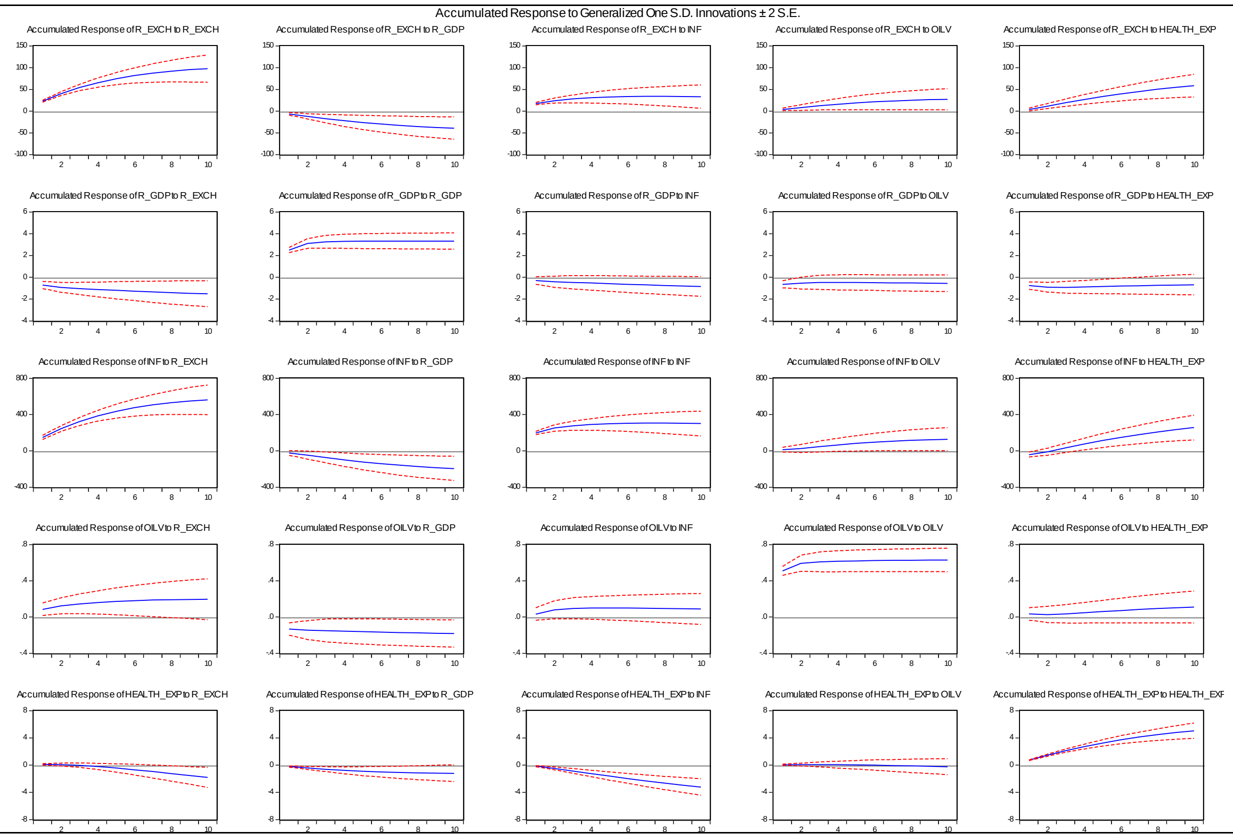
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, EDUCATION_EXP= education expenditure

Appendix C.11. Cumulative generalised impulse responses of oil price volatility on military expenditure in non-OPEC countries



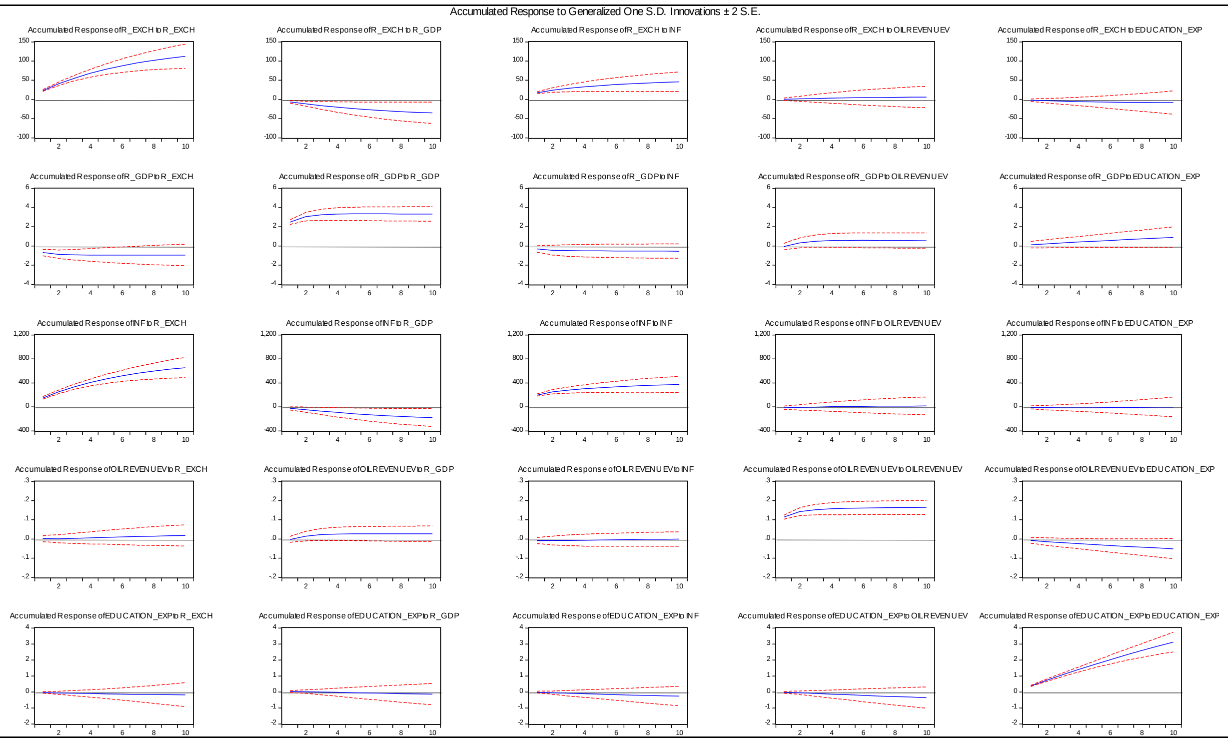
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, MILATARY_EXP= military expenditure

Appendix C.12. Cumulative generalised impulse responses of oil price volatility on health expenditure in non-OPEC countries



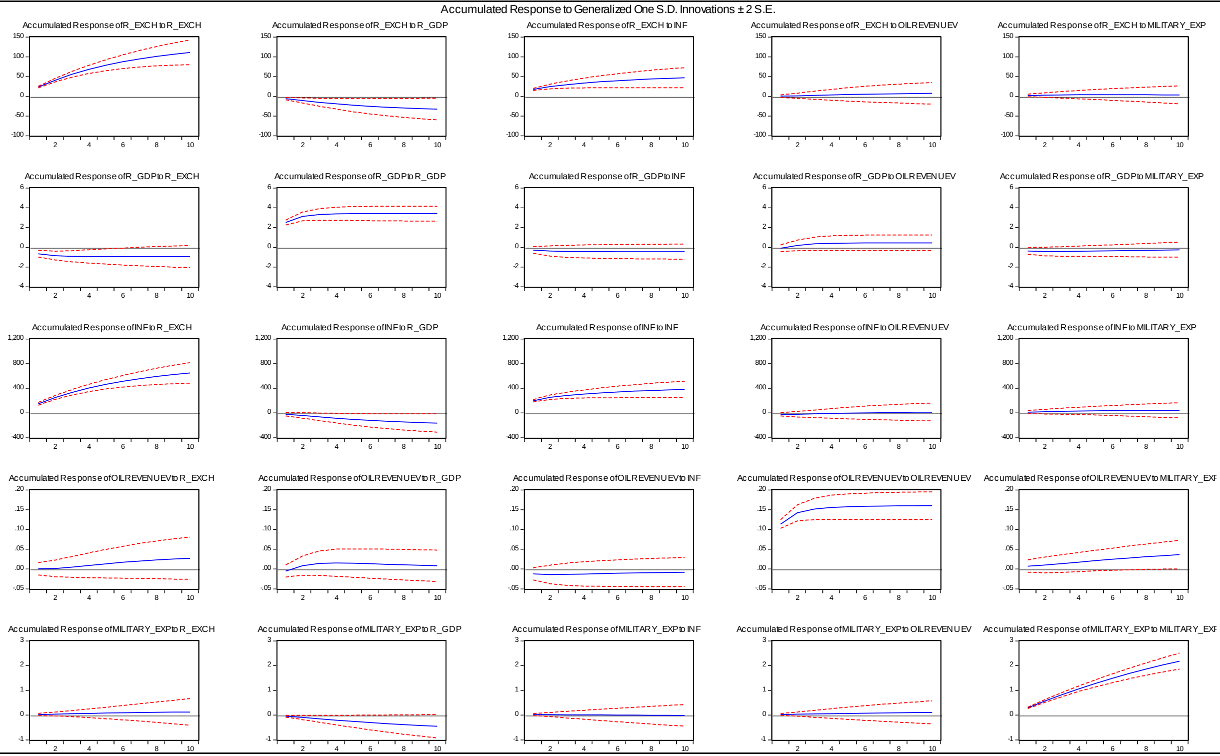
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILV= oil price volatility, HEALTH_EXP= health expenditure

Appendix C.13. Cumulative generalised impulse responses of oil revenue volatility on education expenditure in non-OPEC countries



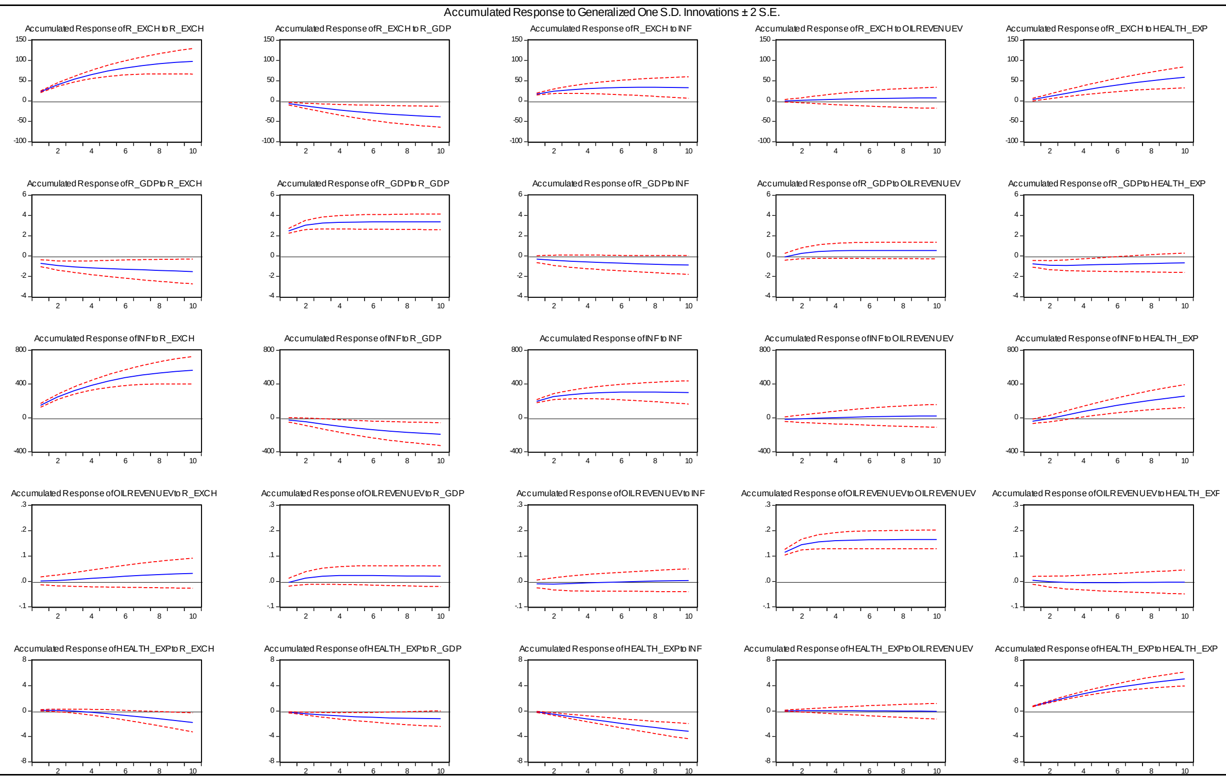
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILREVENUEV= oil revenue volatility, EDUCATION_EXP= education expenditure

Appendix C.14. Cumulative generalised impulse responses of oil revenue volatility on military expenditure in non-OPEC countries



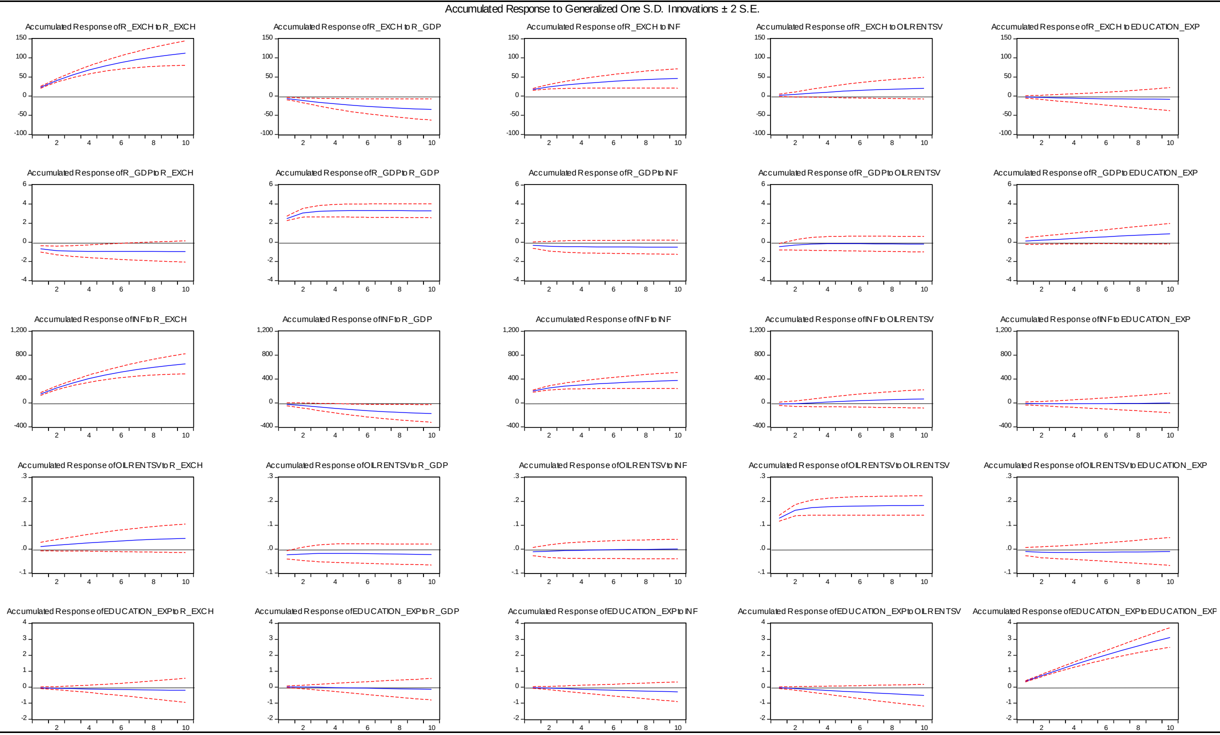
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEV= oil revenue volatility, MILATARY_EXP= military expenditure

Appendix C.15. Cumulative generalised impulse responses of oil revenue volatility on health expenditure in non-OPEC countries



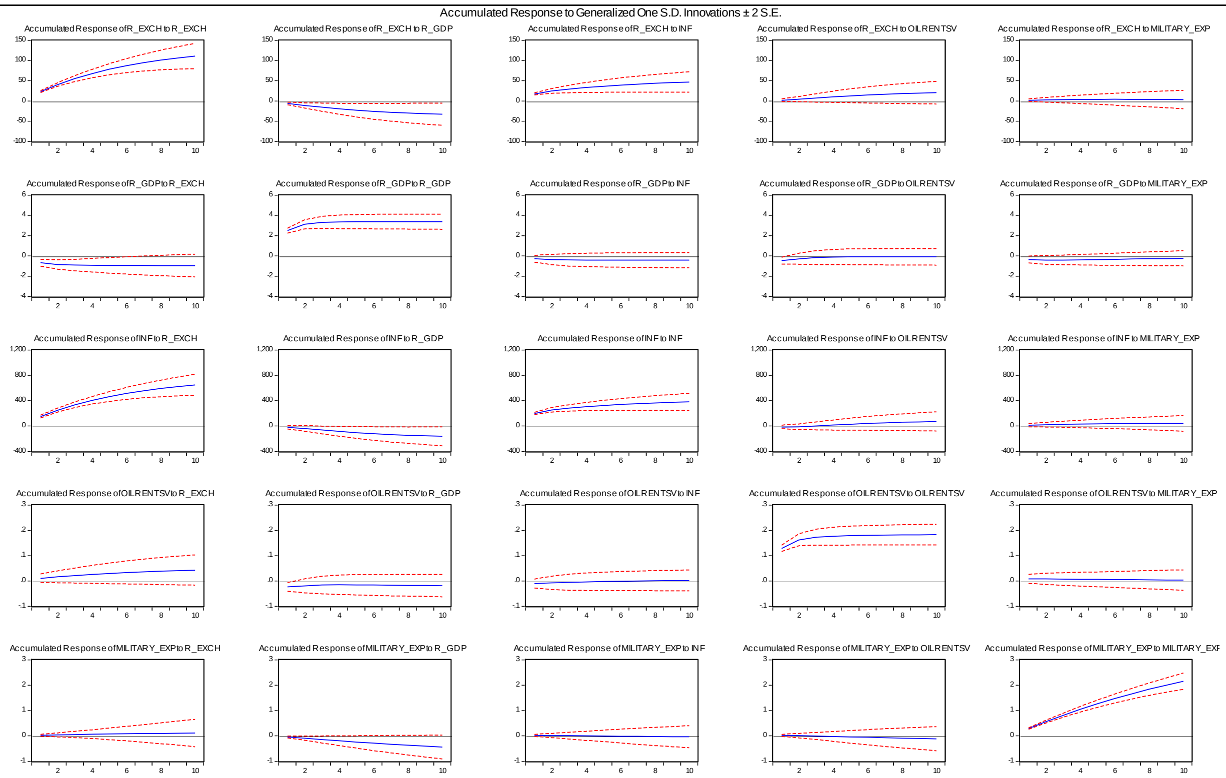
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEV= oil revenue volatility, HEALTH_EXP= health expenditure

Appendix C.16. Cumulative generalised impulse responses of oil rents volatility on education expenditure non-OPEC countries



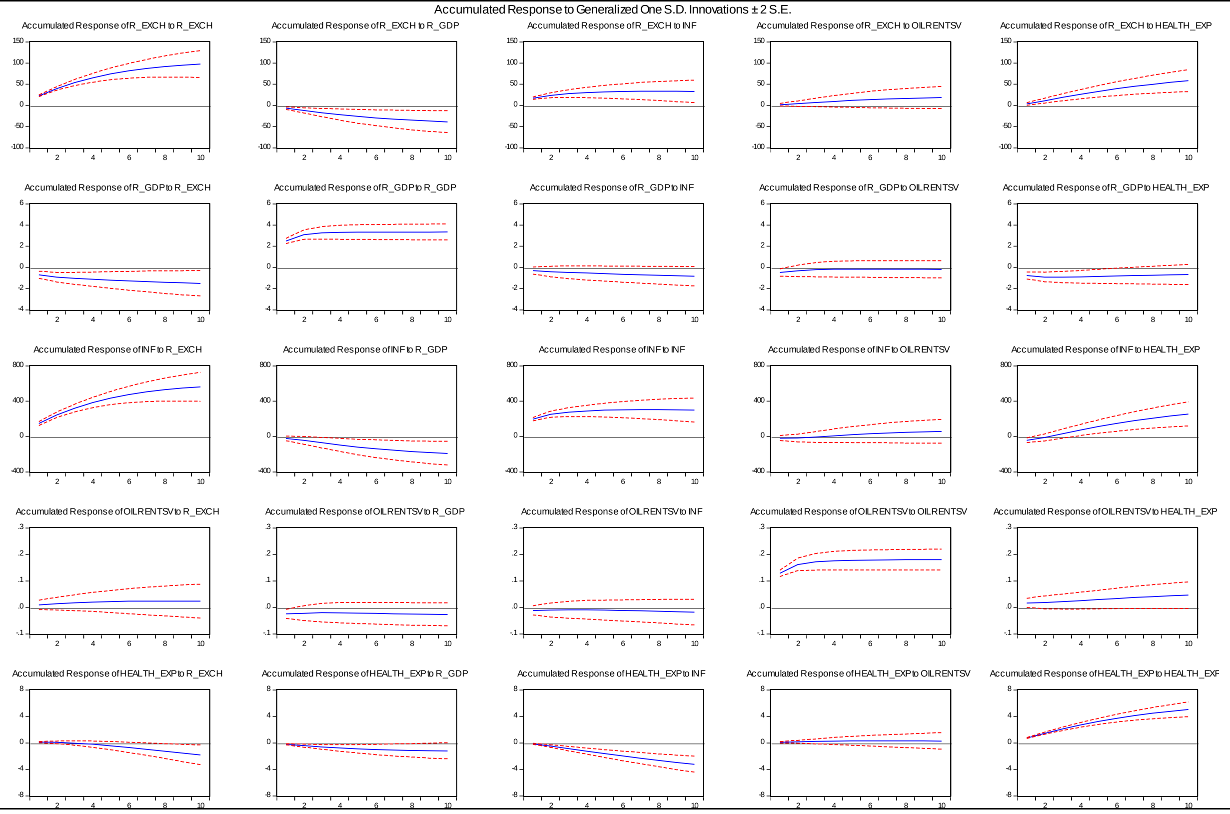
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, EDUCATION_EXP= education expenditure

Appendix C.17. Cumulative generalised impulse responses of oil rents volatility on military expenditure non-OPEC countries



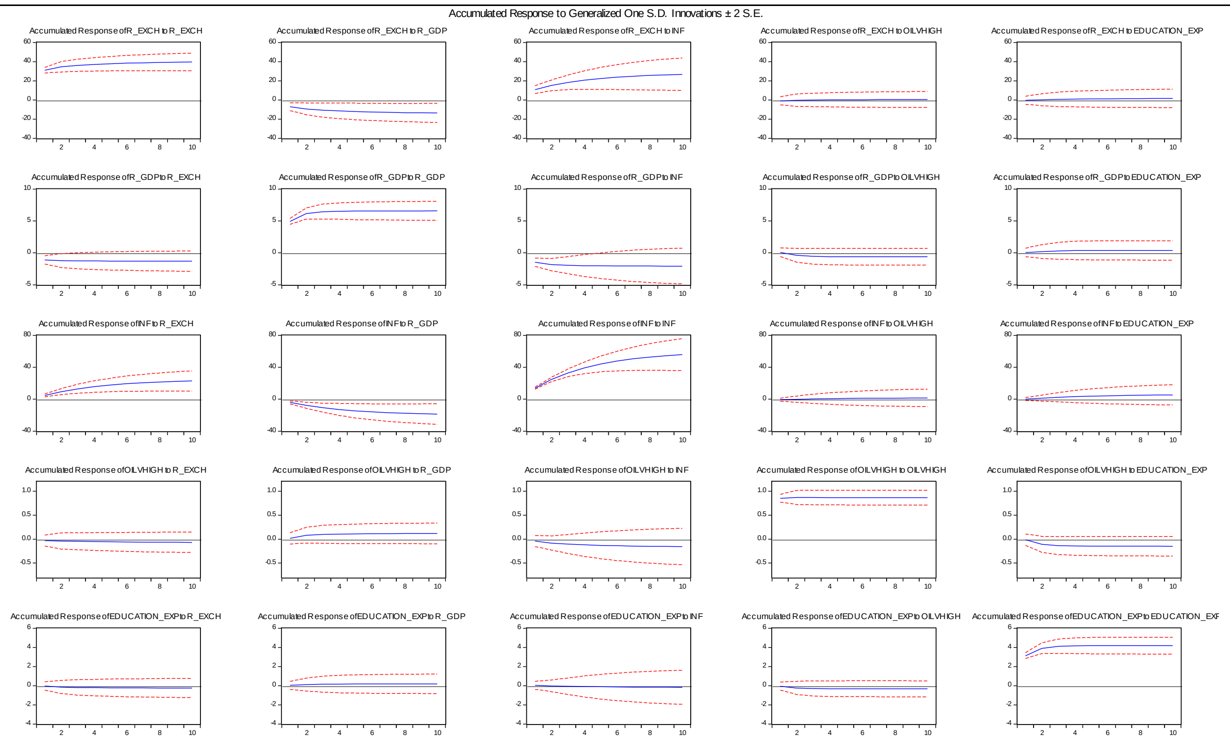
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, MILITARY_EXP= military expenditure

Appendix C.18. Cumulative generalised impulse responses of oil rents volatility on health expenditure non-OPEC countries



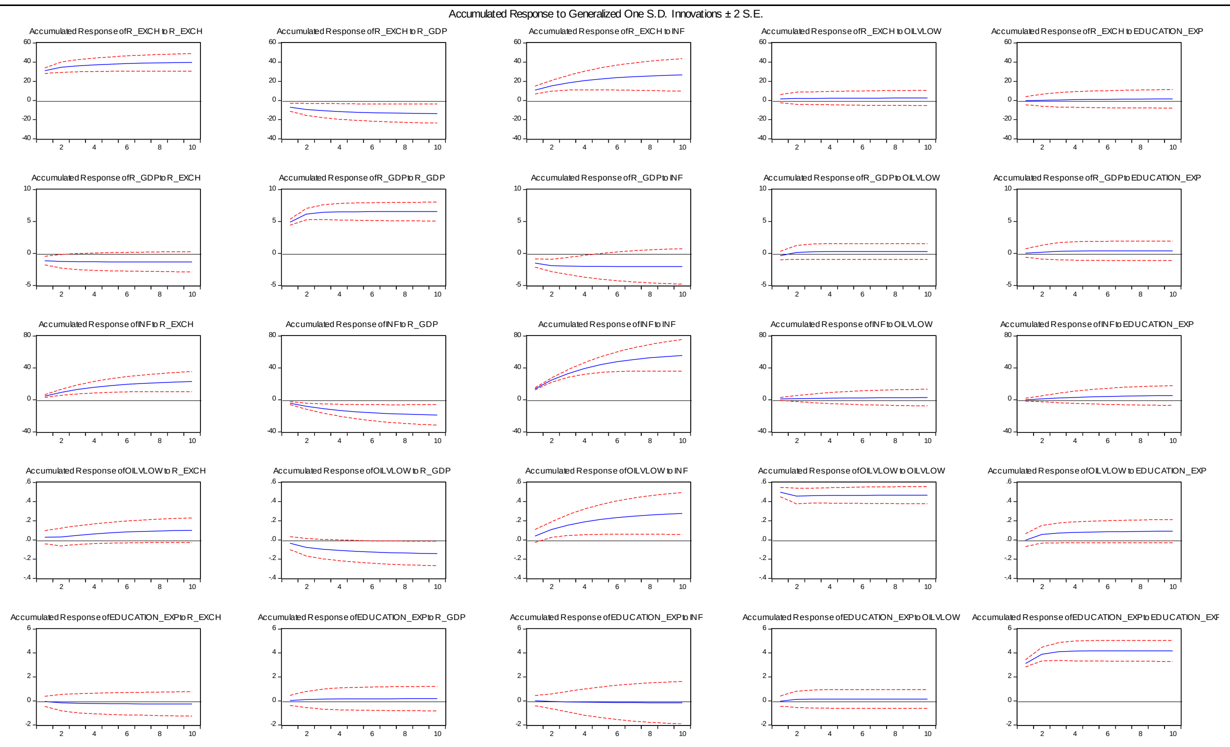
Note: R_EXCH= exchange rate growth, R_GDP= economic growth, INF= inflation rate, OILRENTSV= oil rents volatility, HEALTH_EXP= health expenditure

Appendix C.19. Cumulative generalised impulse responses of oil price high volatility on education expenditure in OPEC countries



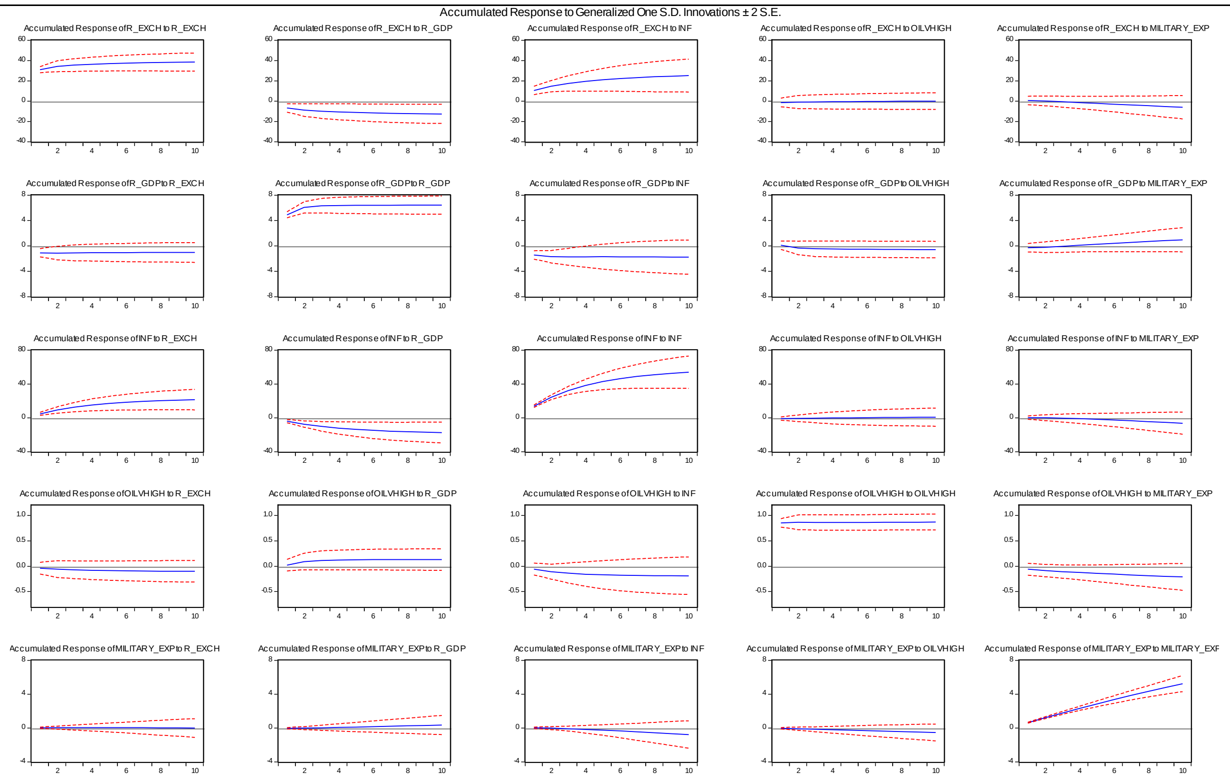
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, EDUCATION_EXP= education expenditure

Appendix C.20. Cumulative generalised impulse responses of oil price low volatility on education expenditure in OPEC countries



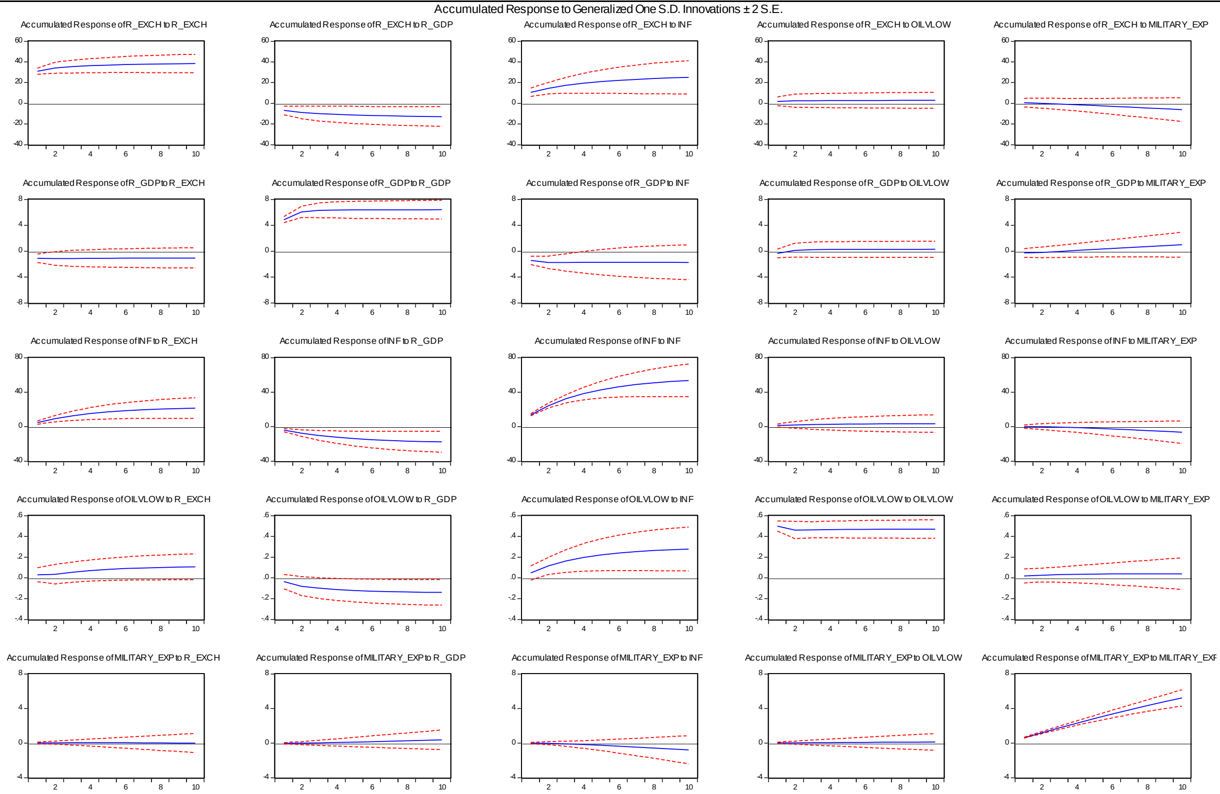
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price low volatility, EDUCATION_EXP= education expenditure

Appendix C.21. Cumulative generalised impulse responses of oil price high volatility on military expenditure in OPEC countries



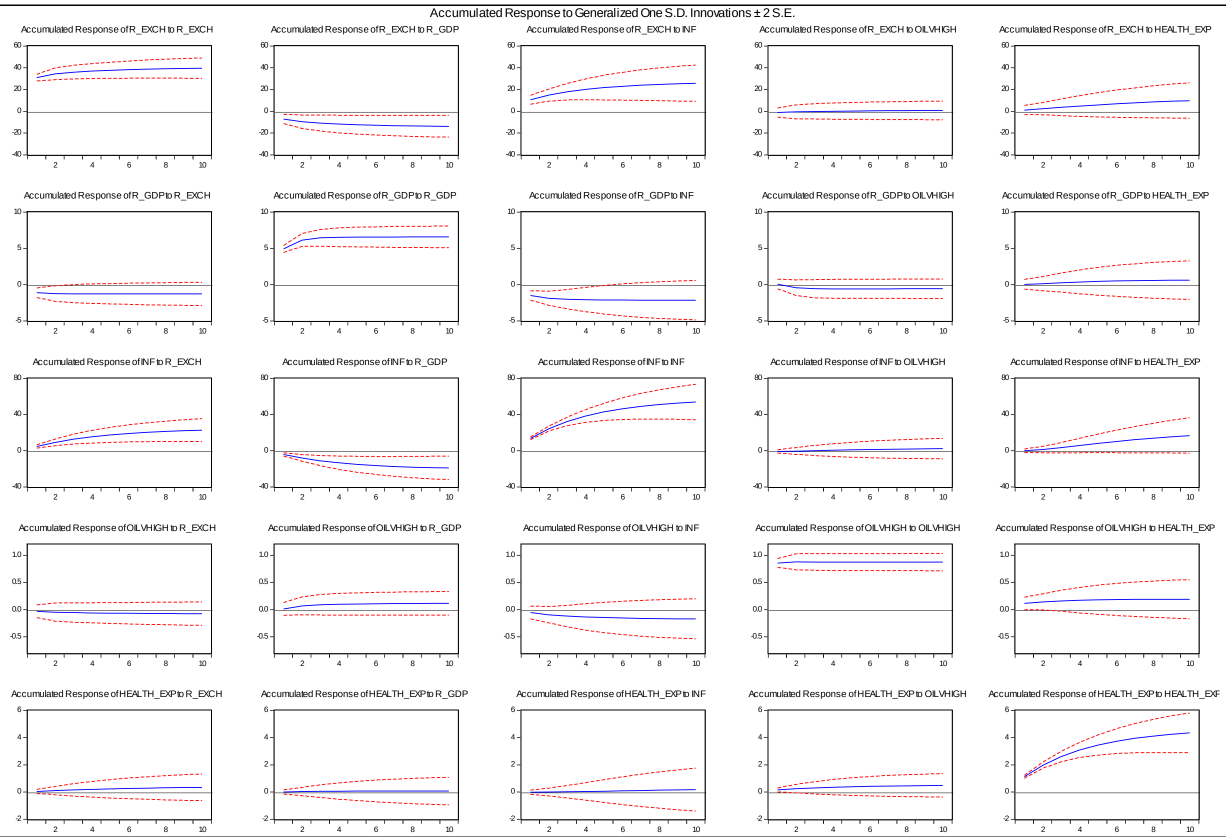
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, MILATARY_EXP= military expenditure

Appendix C.22. Cumulative generalised impulse responses of oil price low volatility on military expenditure in OPEC countries



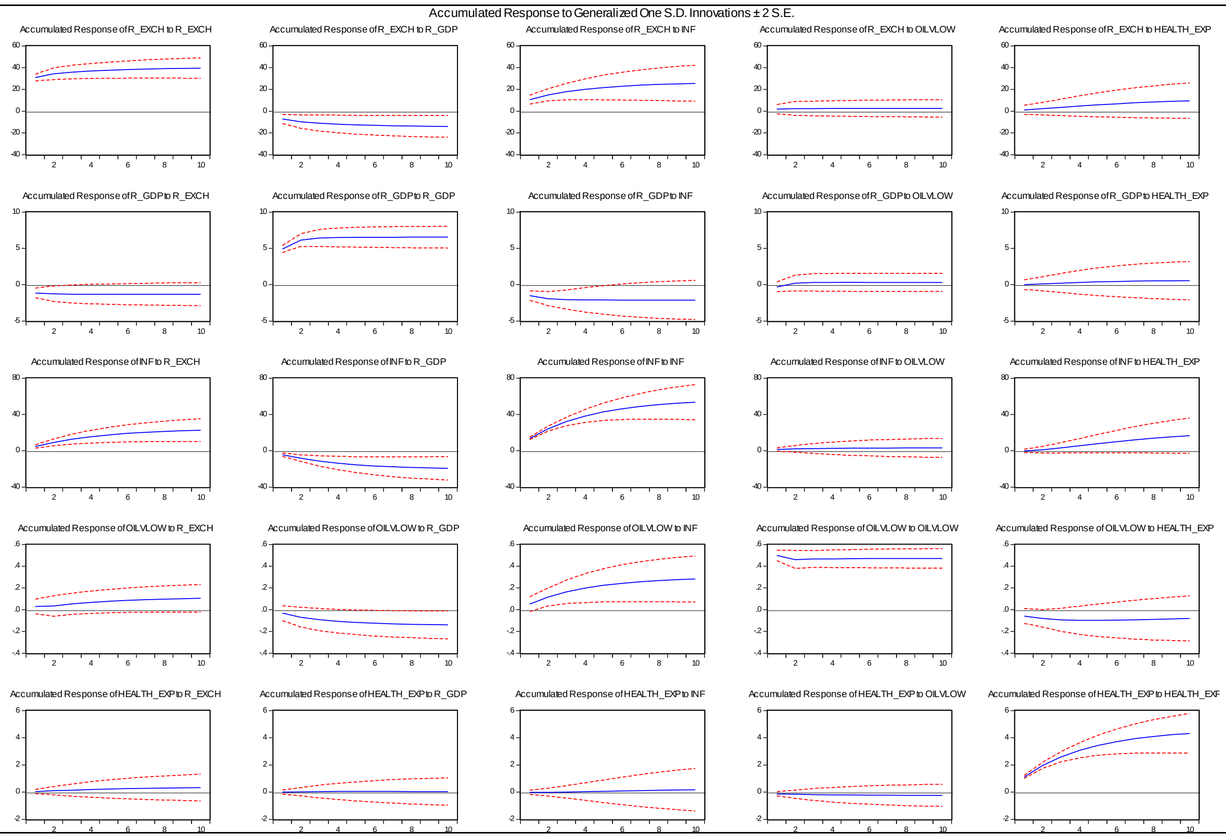
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, MILATARY_EXP= military expenditure

Appendix C.23. Cumulative generalised impulse responses of oil price high volatility on health expenditure in OPEC countries



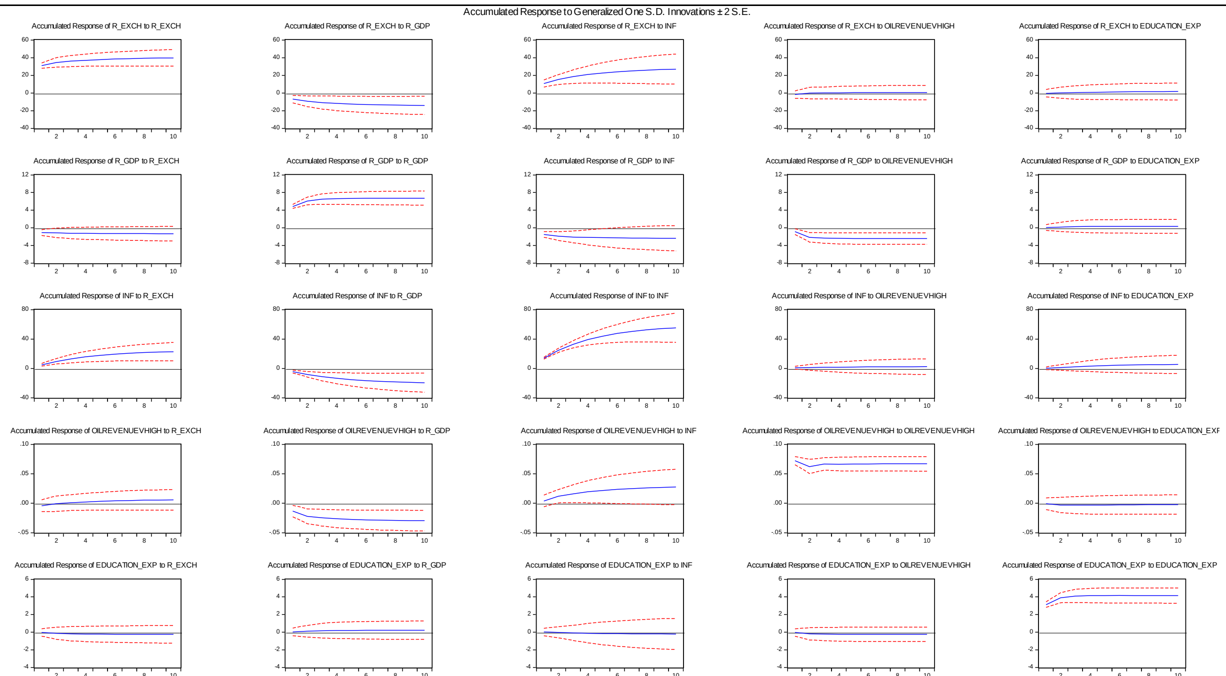
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, HEALTH_EXP= health expenditure

Appendix C.24. Cumulative generalised impulse responses of oil price low volatility on health expenditure in OPEC countries



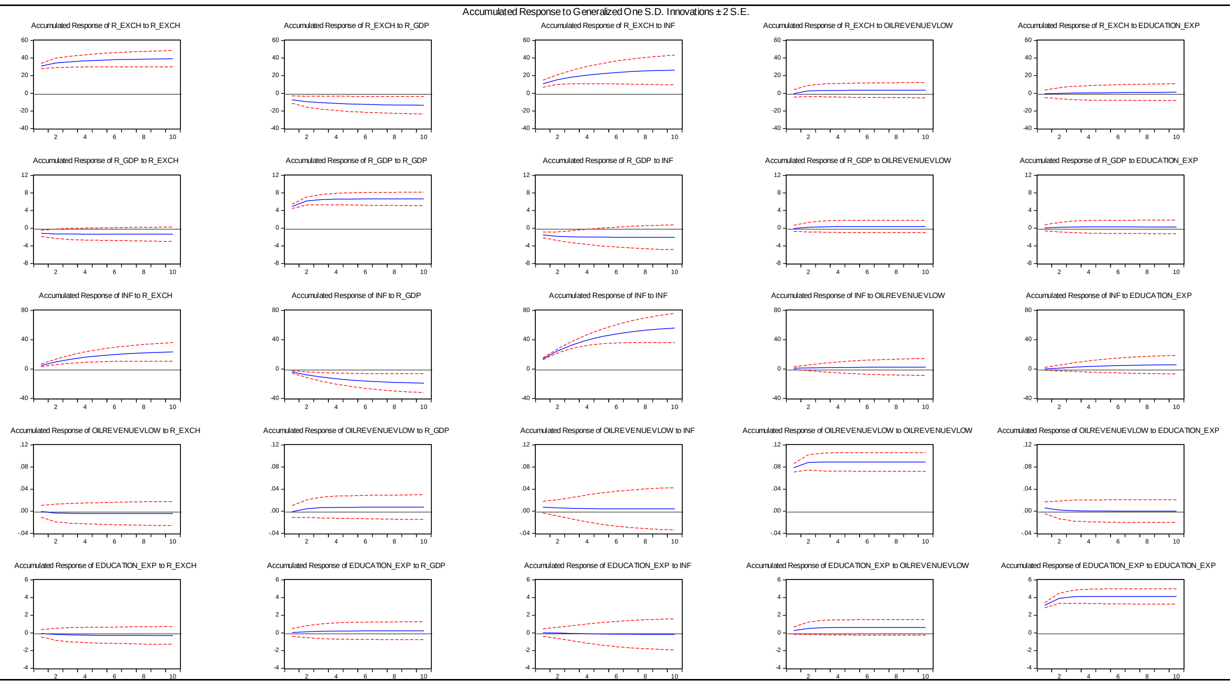
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, HEALTH_EXP= health expenditure

Appendix C.25. Cumulative generalised impulse responses of oil revenue high volatility on education expenditure in OPEC countries



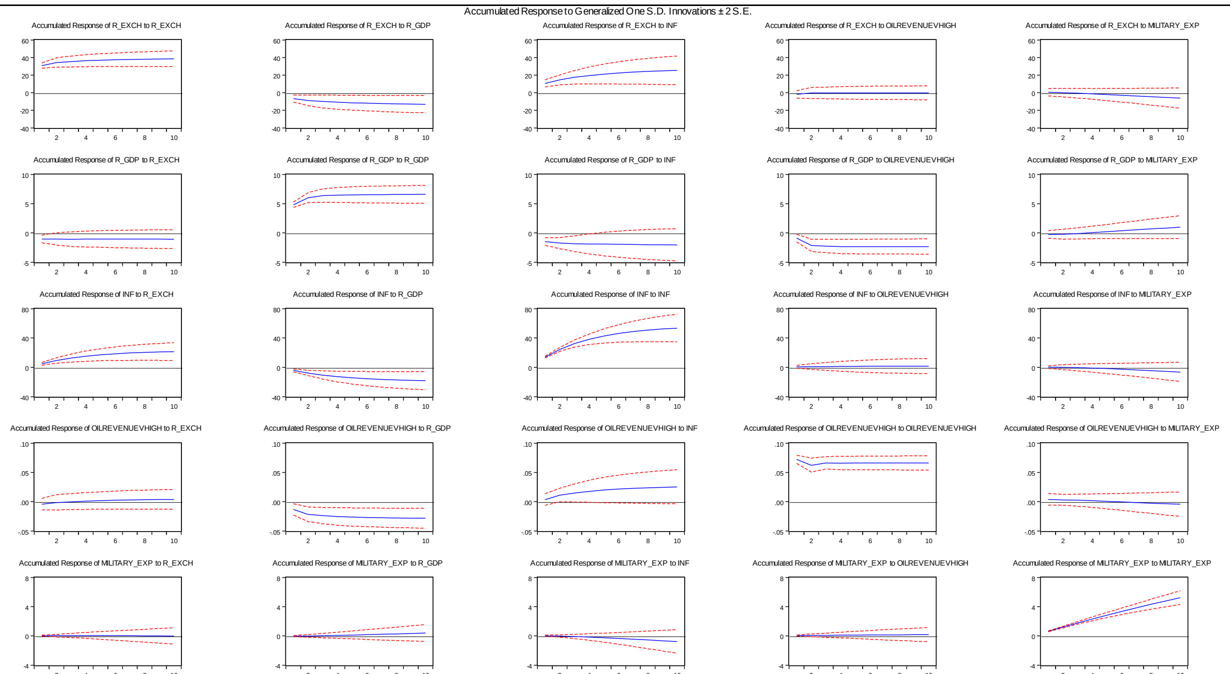
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, EDUCATION_EXP= education expenditure

Appendix C.26. Cumulative generalised impulse responses of oil revenue low volatility on education expenditure in OPEC countries



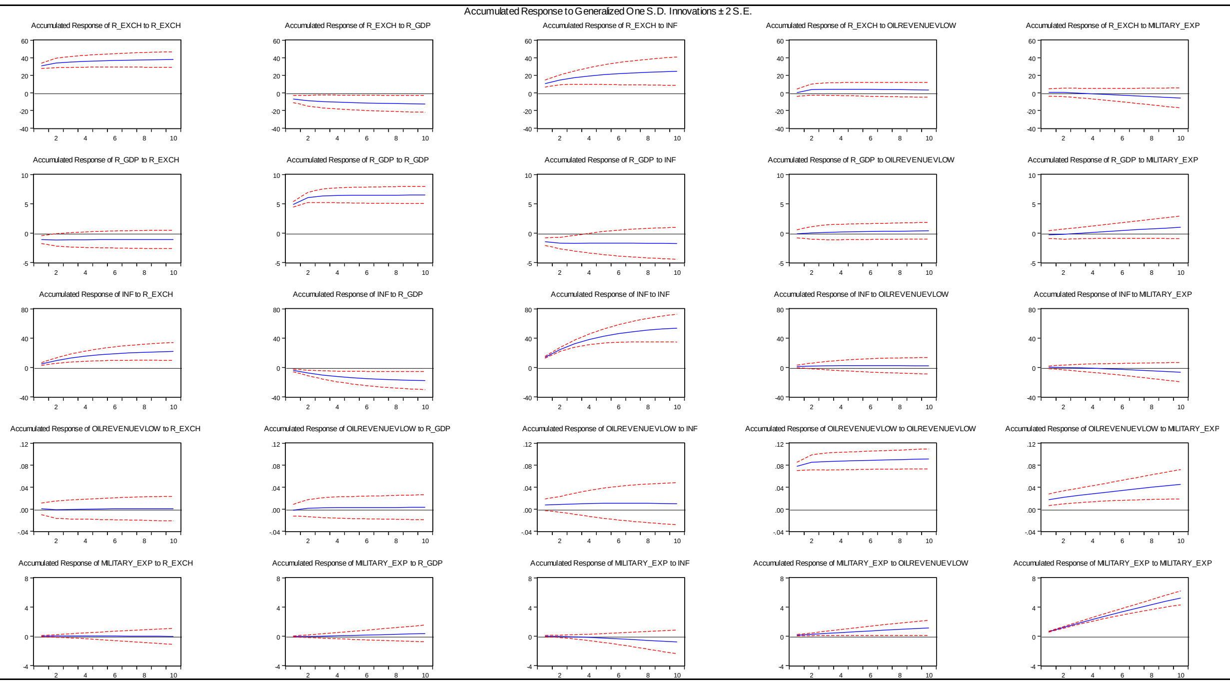
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, EDUCATION_EXP= education expenditure

Appendix C.27. Cumulative generalised impulse responses of oil revenue high volatility on military expenditure in OPEC countries



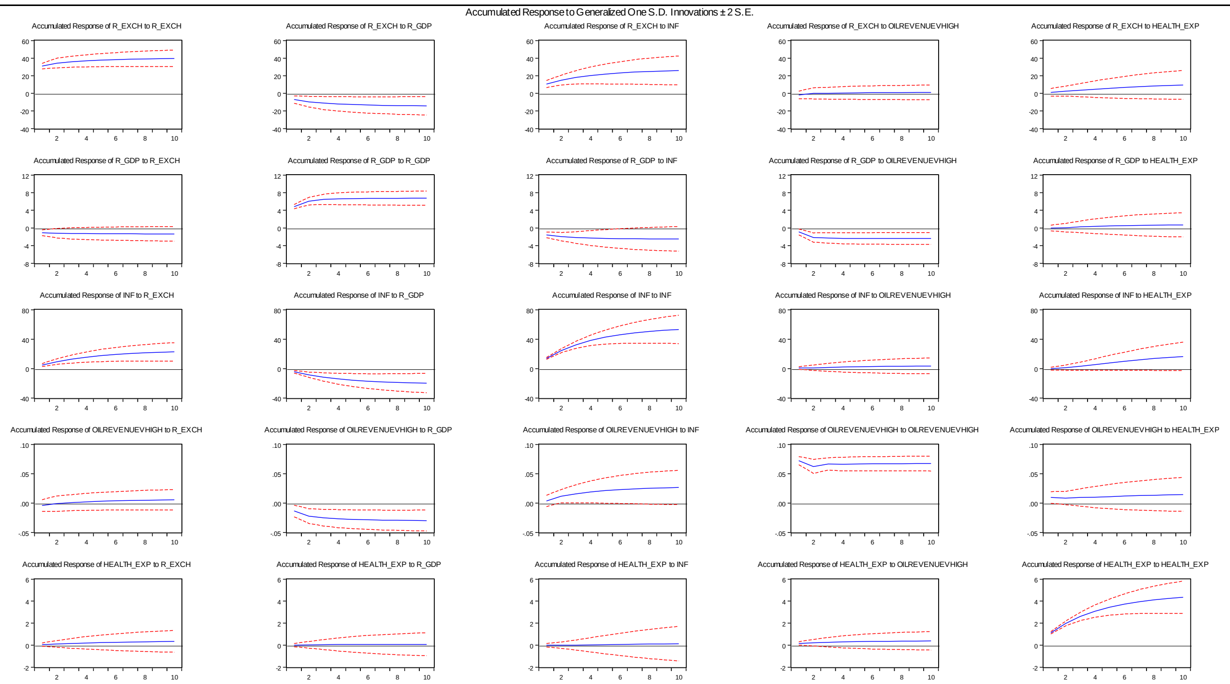
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, MILITARY_EXP= military expenditure

Appendix C.28. Cumulative generalised impulse responses of oil revenue low volatility on military expenditure in OPEC countries



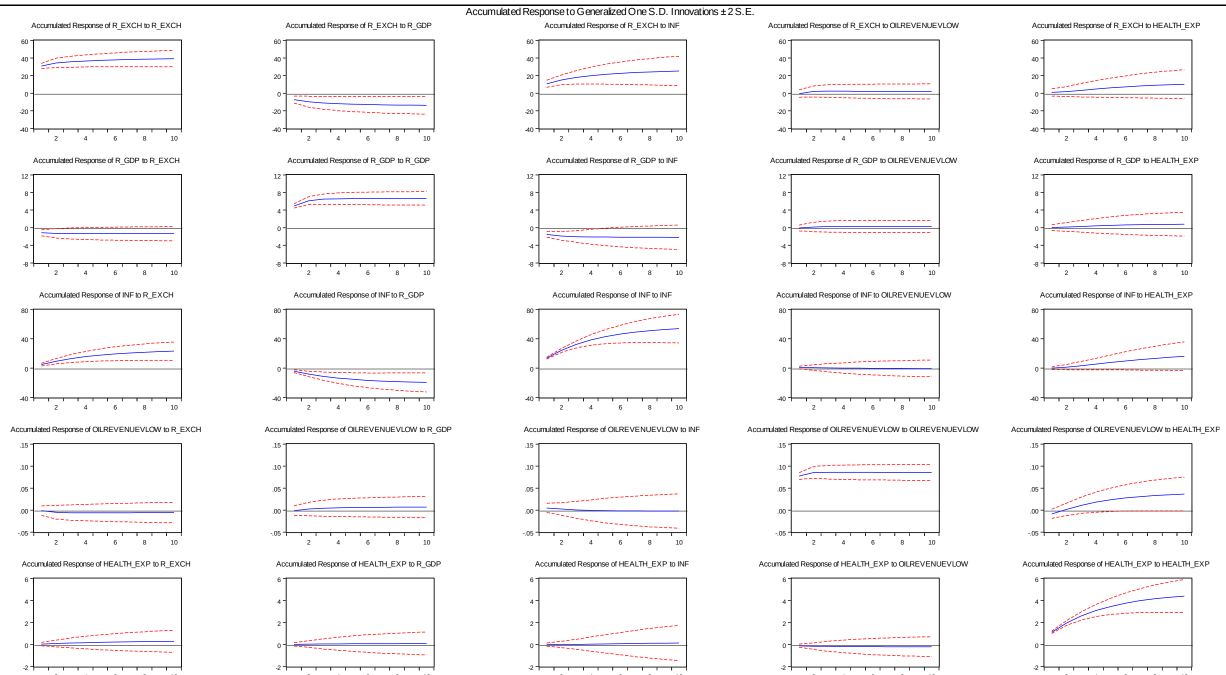
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, MILITARY_EXP= military expenditure

Appendix C.29. Cumulative generalised impulse responses of oil revenue high volatility on health expenditure in OPEC countries



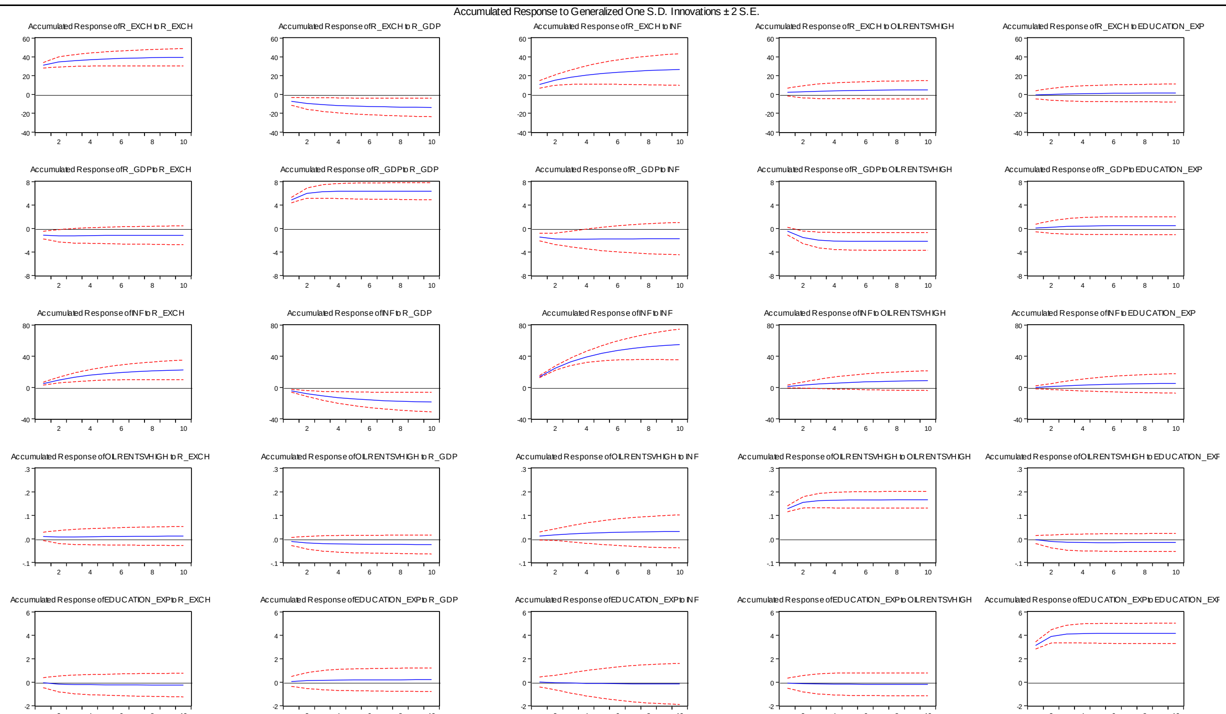
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, HEALTH_EXP= health expenditure

Appendix C.30. Cumulative generalised impulse responses of oil revenue low volatility on health expenditure in OPEC countries



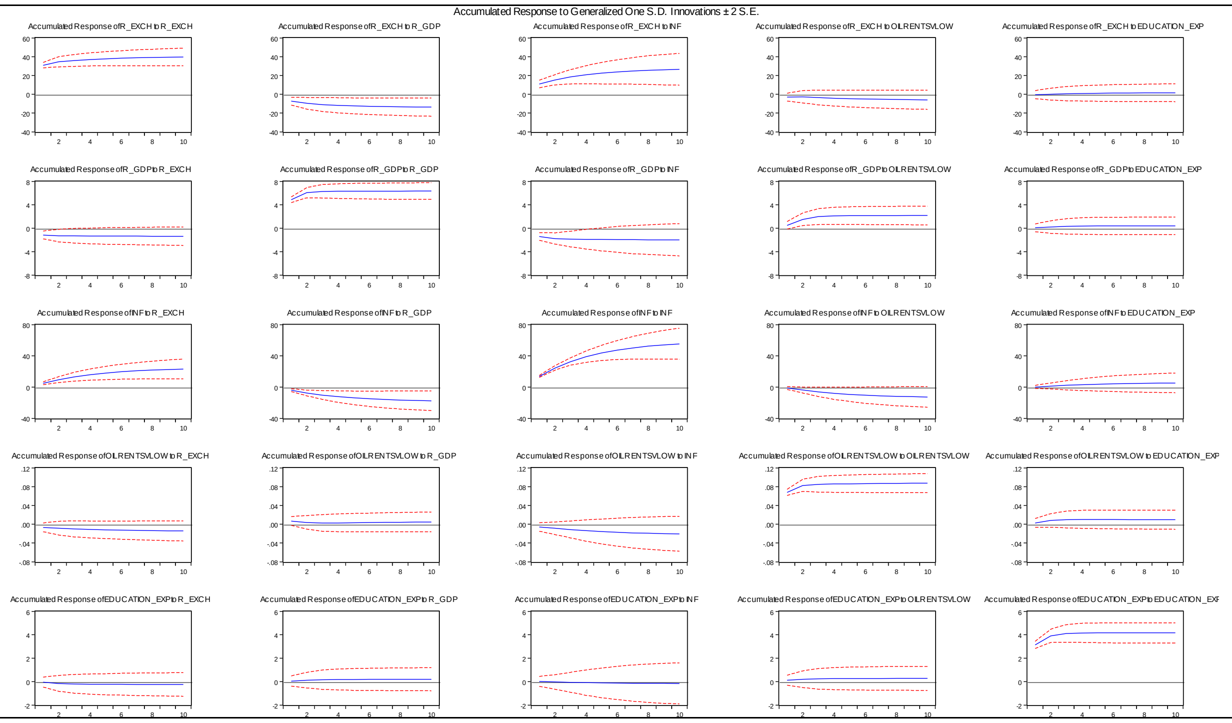
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, HEALTH_EXP= health expenditure

Appendix C.31. Cumulative generalised impulse responses of oil rent high volatility on education expenditure in OPEC countries



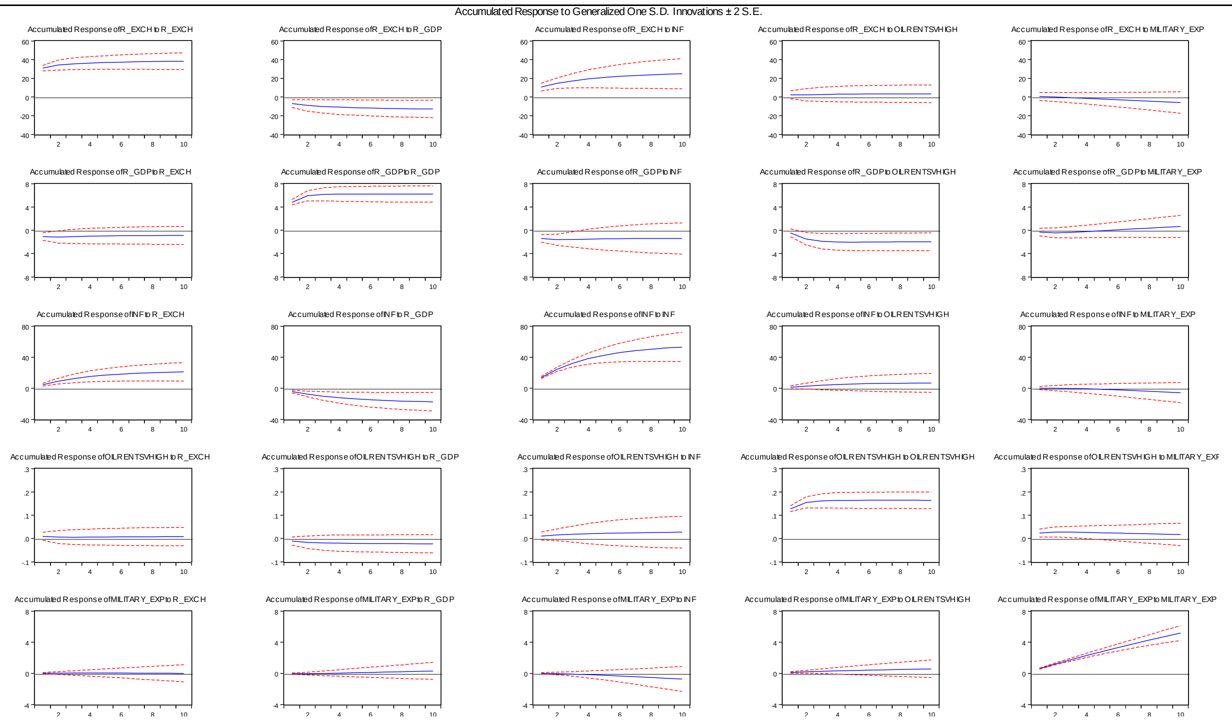
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, EDUCATION_EXP= education expenditure

Appendix C.32. Cumulative generalised impulse responses of oil rent low volatility on education expenditure in OPEC countries



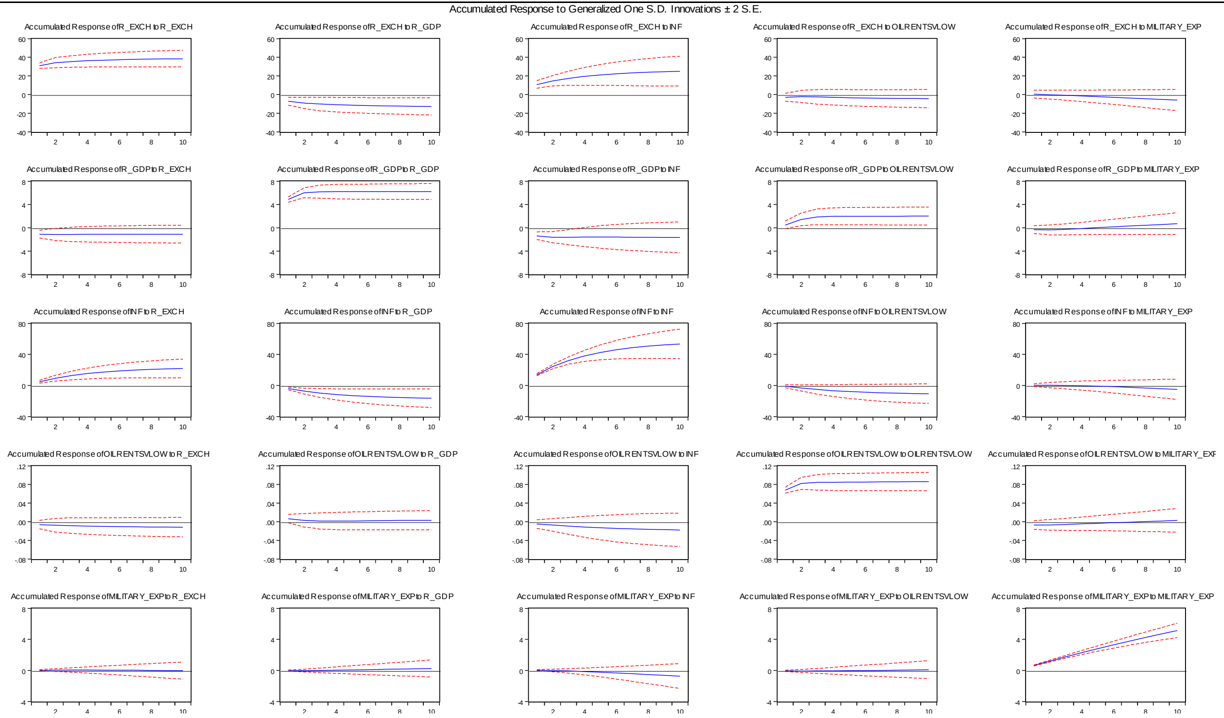
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, EDUCATION_EXP= education expenditure

Appendix C.33. Cumulative generalised impulse responses of oil rent high volatility on military expenditure in OPEC countries



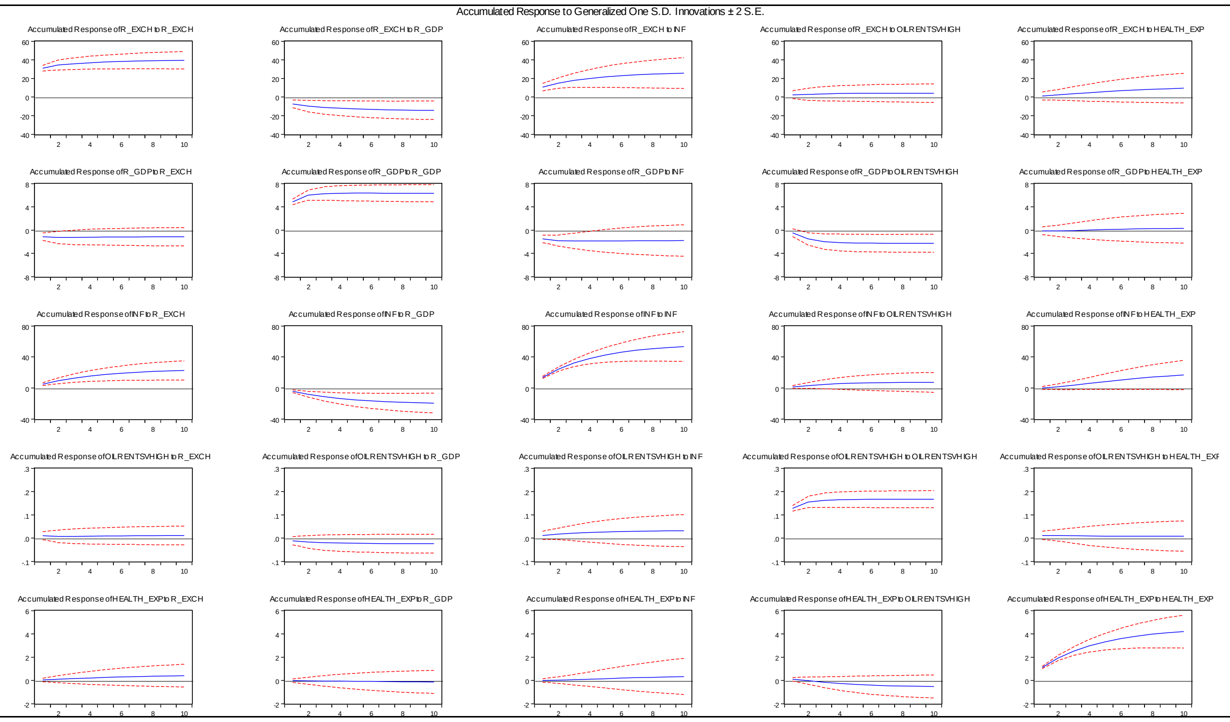
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, MILITARY_EXP= military expenditure

Appendix C.34. Cumulative generalised impulse responses of oil rent low volatility on military expenditure in OPEC countries



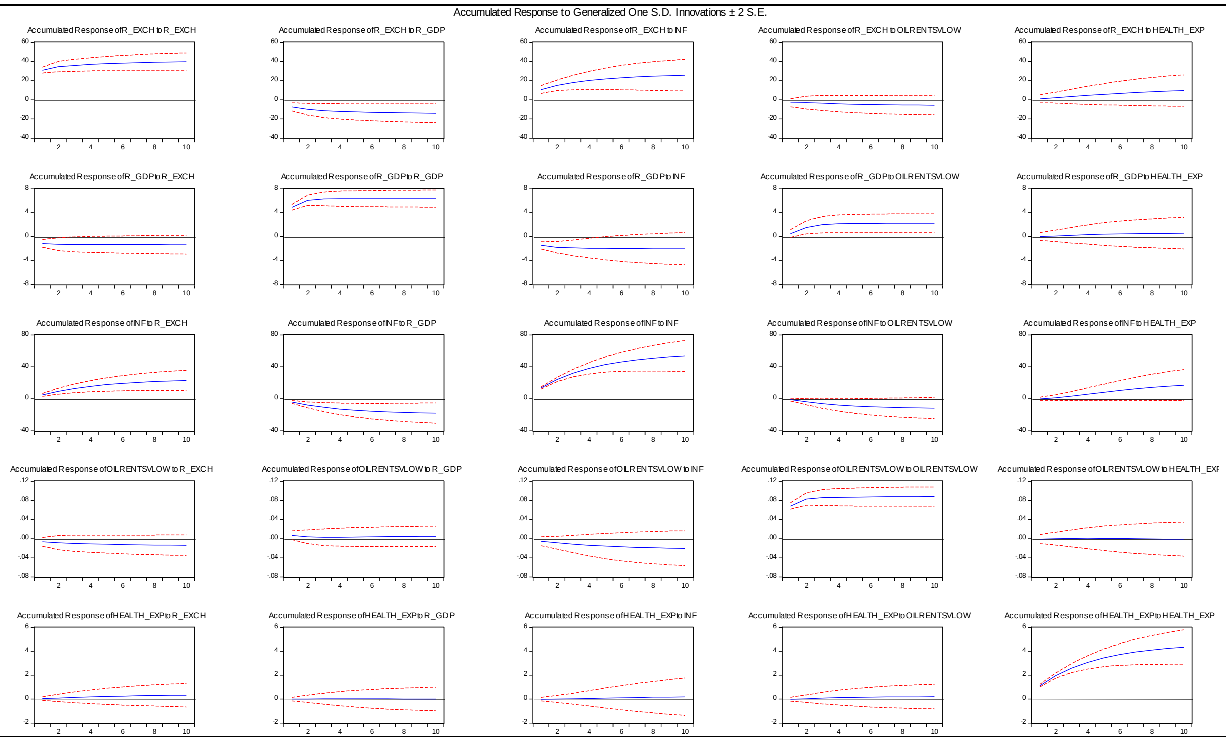
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, MILITARY_EXP= military expenditure

Appendix C.35. Cumulative generalised impulse responses of oil rent high volatility on health expenditure in OPEC countries



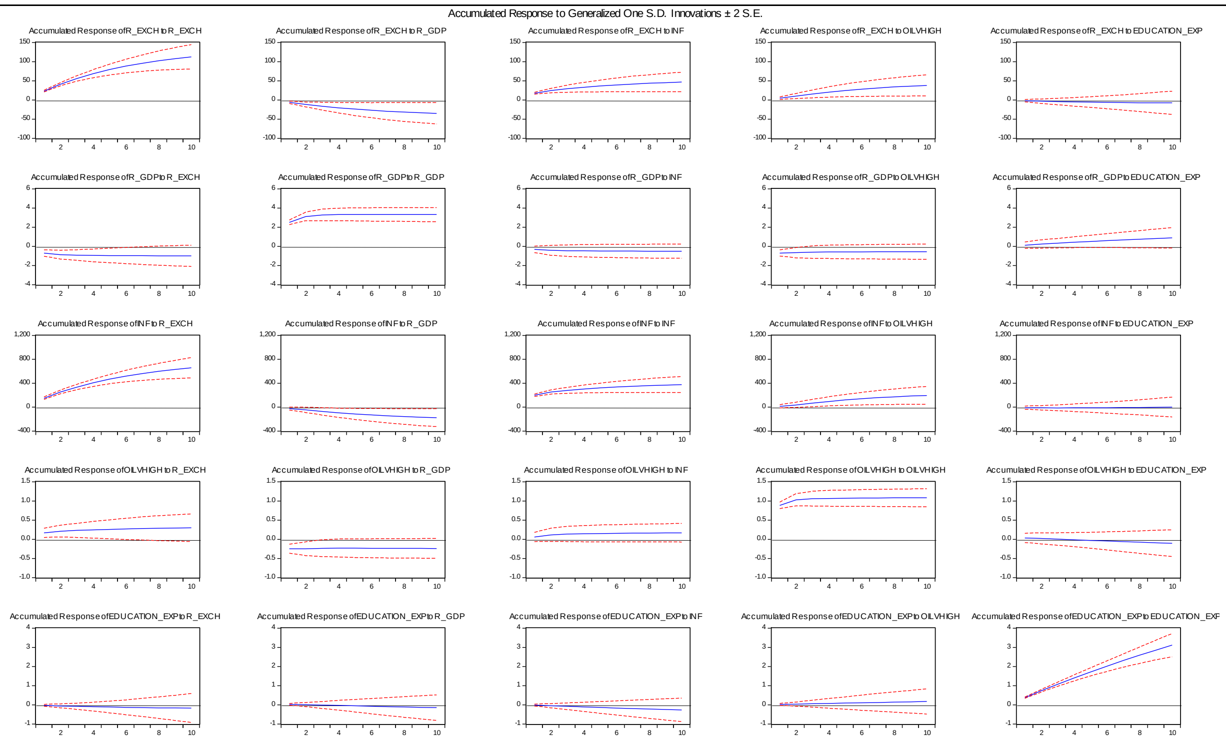
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, HEALTH_EXP= health expenditure

Appendix C.36. Cumulative generalised impulse responses of oil rent low volatility on health expenditure in OPEC countries



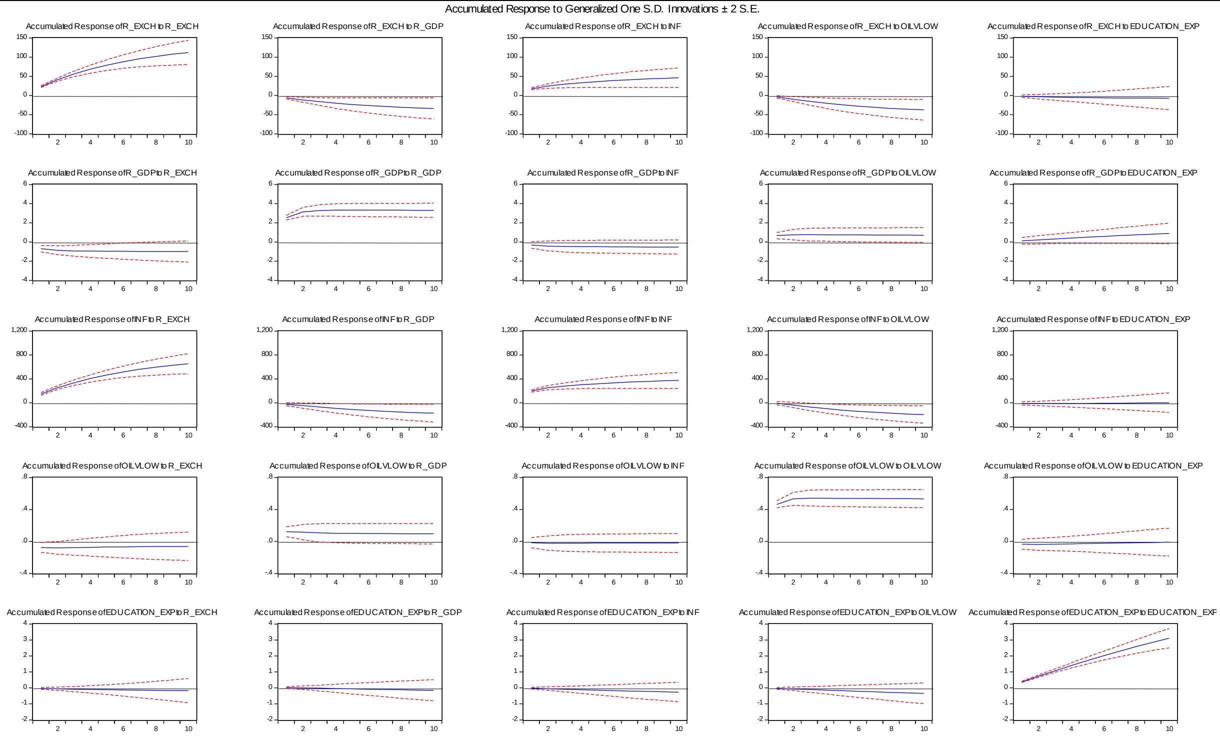
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, HEALTH_EXP= health expenditure

Appendix C.37. Cumulative generalised impulse responses of oil price high volatility on education expenditure in non-OPEC countries



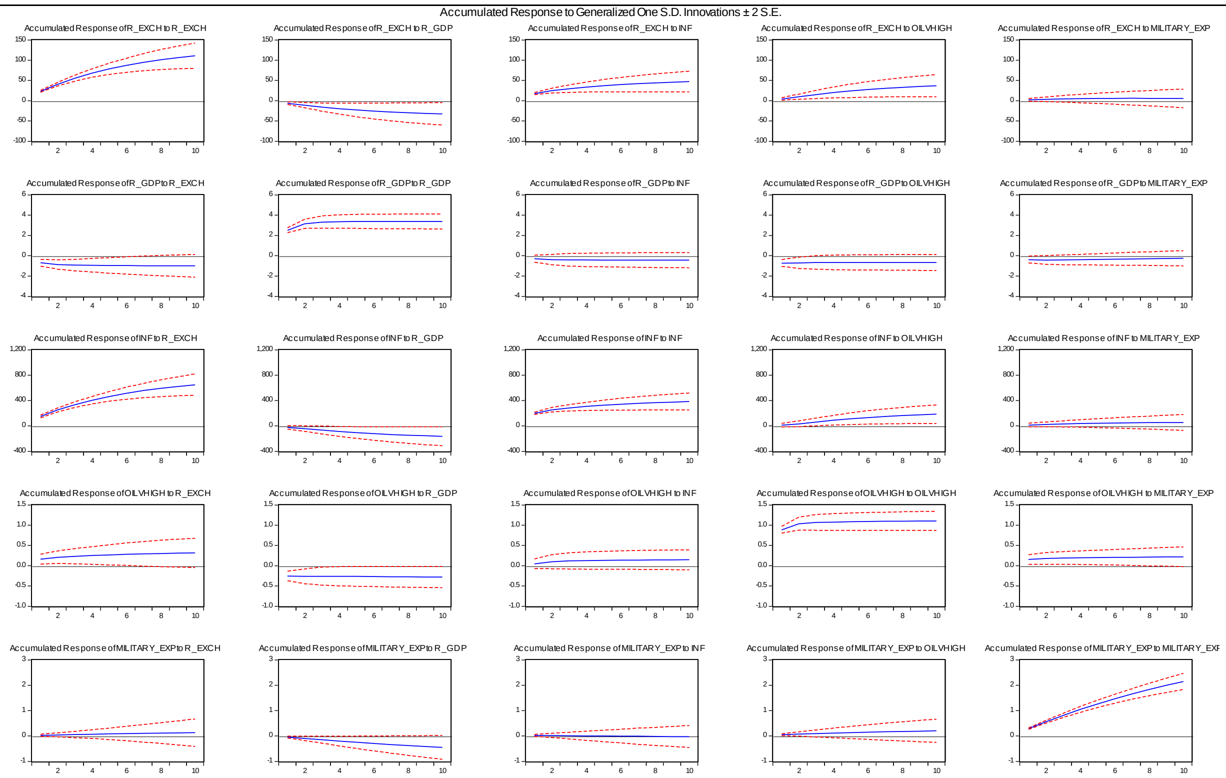
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, EDUCATION_EXP= education expenditure

Appendix C.38. Cumulative generalised impulse responses of oil price low volatility on education expenditure in non-OPEC countries



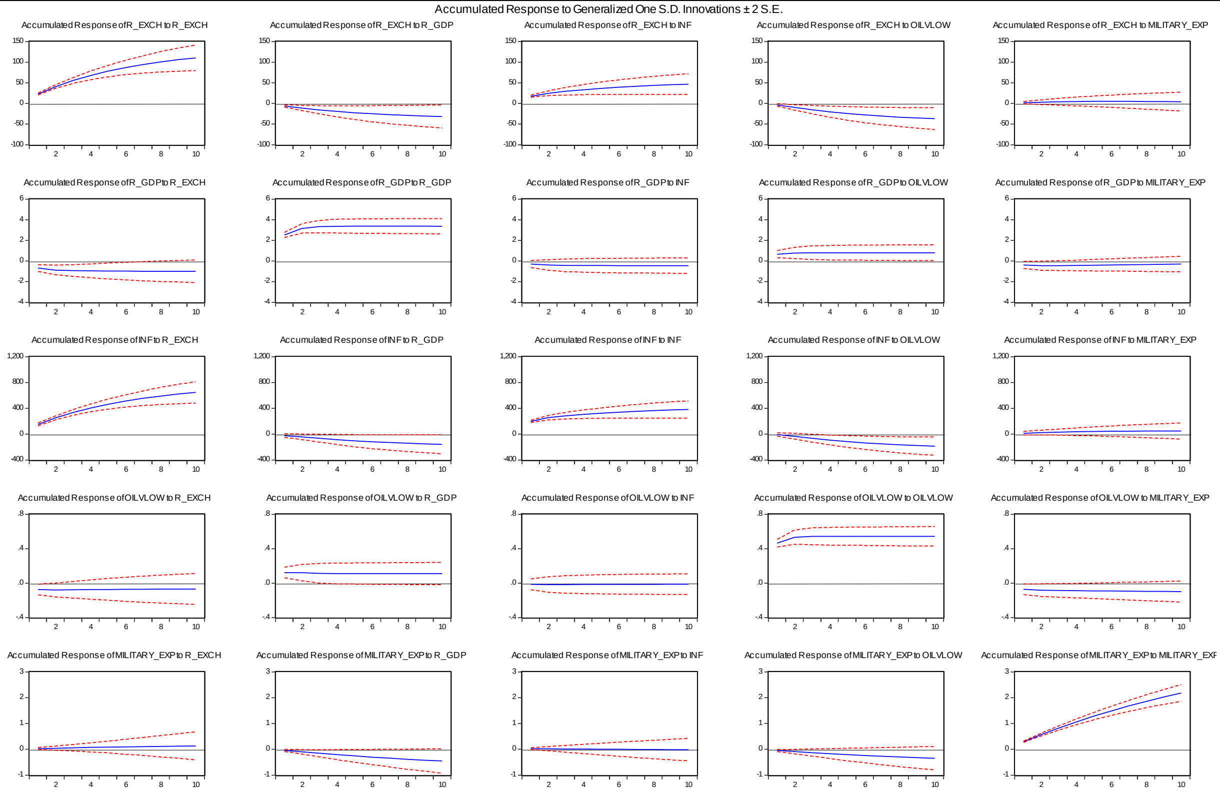
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price low volatility, EDUCATION_EXP= education expenditure

Appendix C.39. Cumulative generalised impulse responses of oil price high volatility on military expenditure in non-OPEC countries



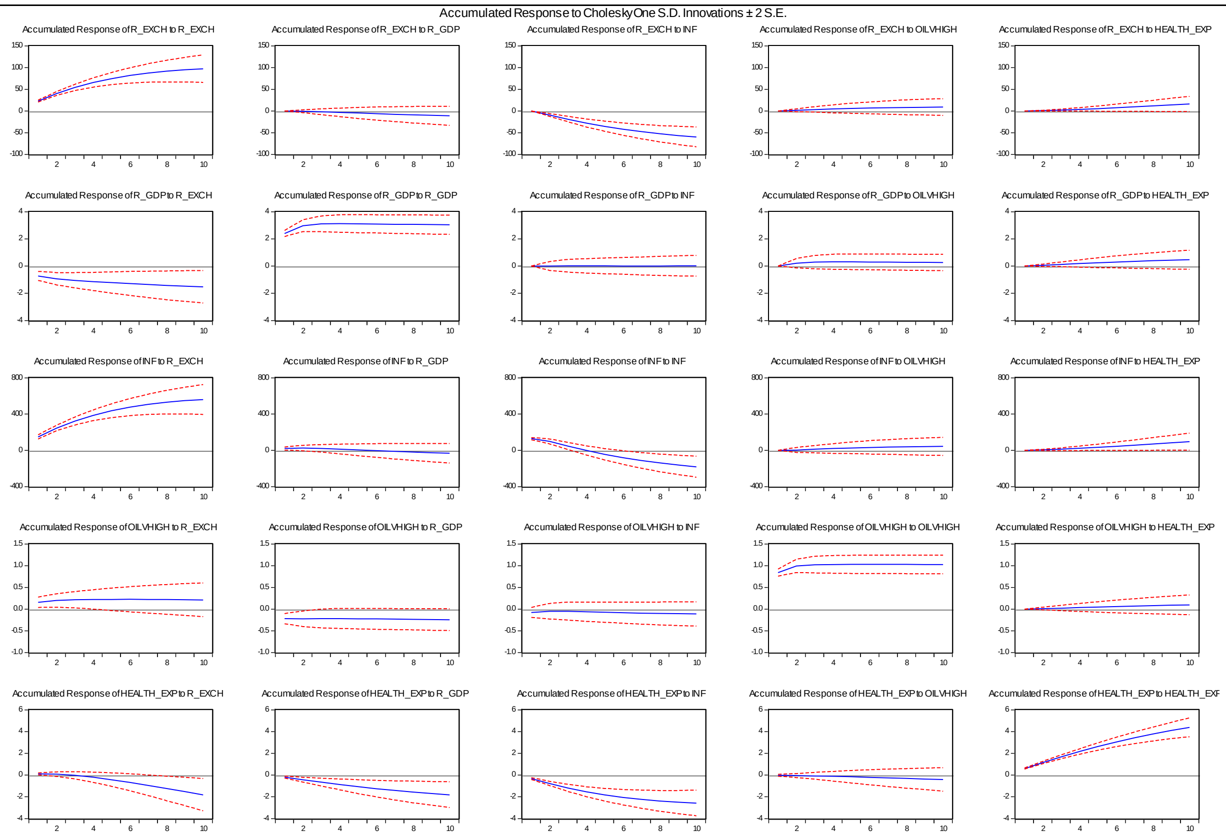
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, MILATARY_EXP= military expenditure

Appendix C.40. Cumulative generalised impulse responses of oil price low volatility on military expenditure in non-OPEC countries



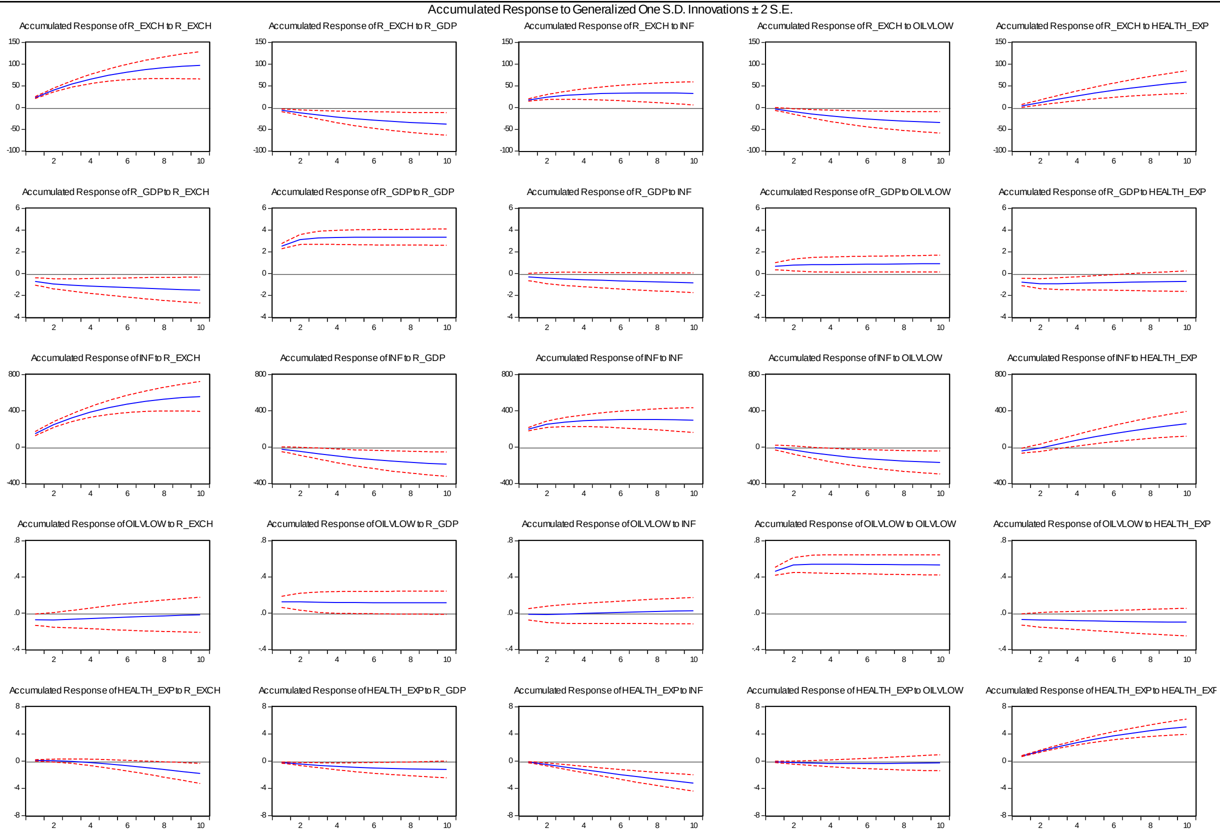
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, MILATARY_EXP= military expenditure

Appendix C.41. Cumulative generalised impulse responses of oil price high volatility on health expenditure in non-OPEC countries



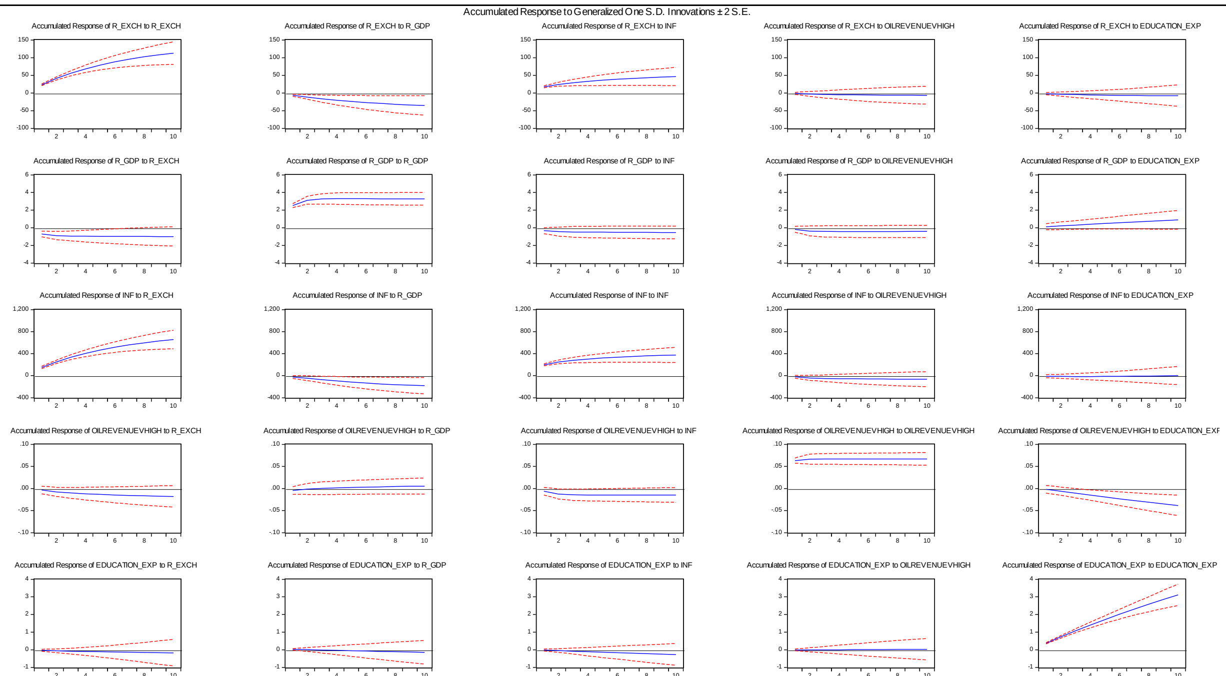
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVHIGH= oil price high volatility, HEALTH_EXP= health expenditure

Appendix C.42. Cumulative generalised impulse responses of oil price low volatility on health expenditure in non-OPEC countries



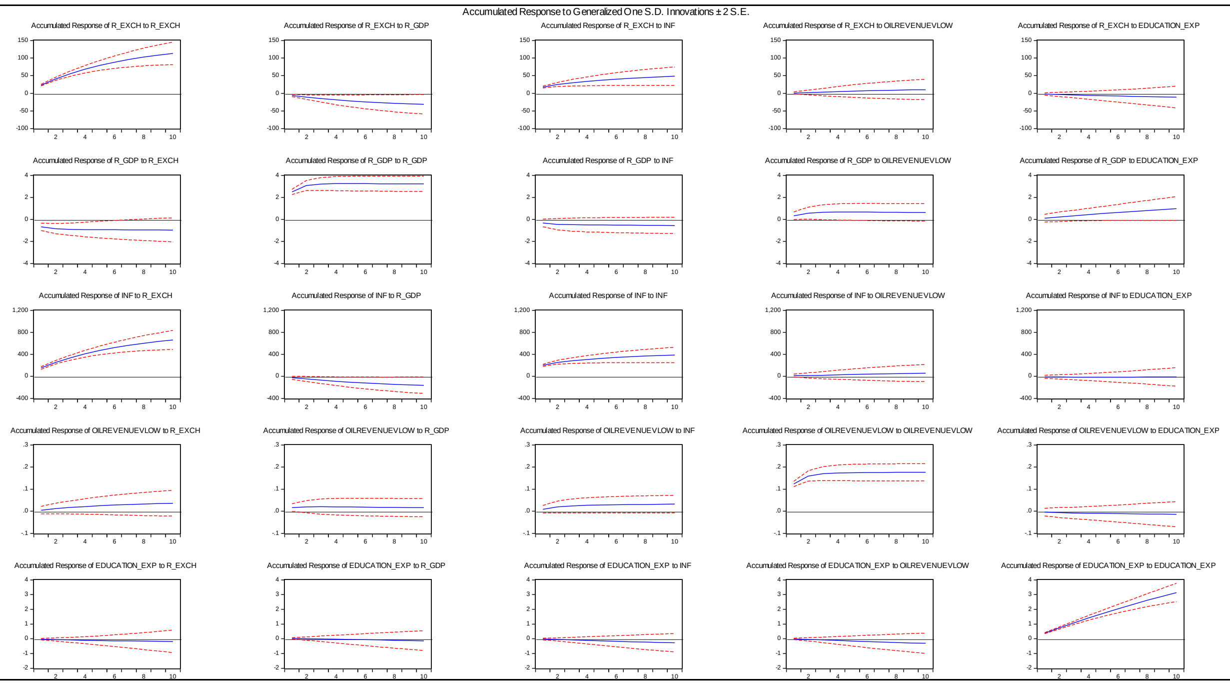
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILVLOW= oil price low volatility, HEALTH_EXP= health expenditure

Appendix C.43. Cumulative generalised impulse responses of oil revenue high volatility on education expenditure in non-OPEC countries



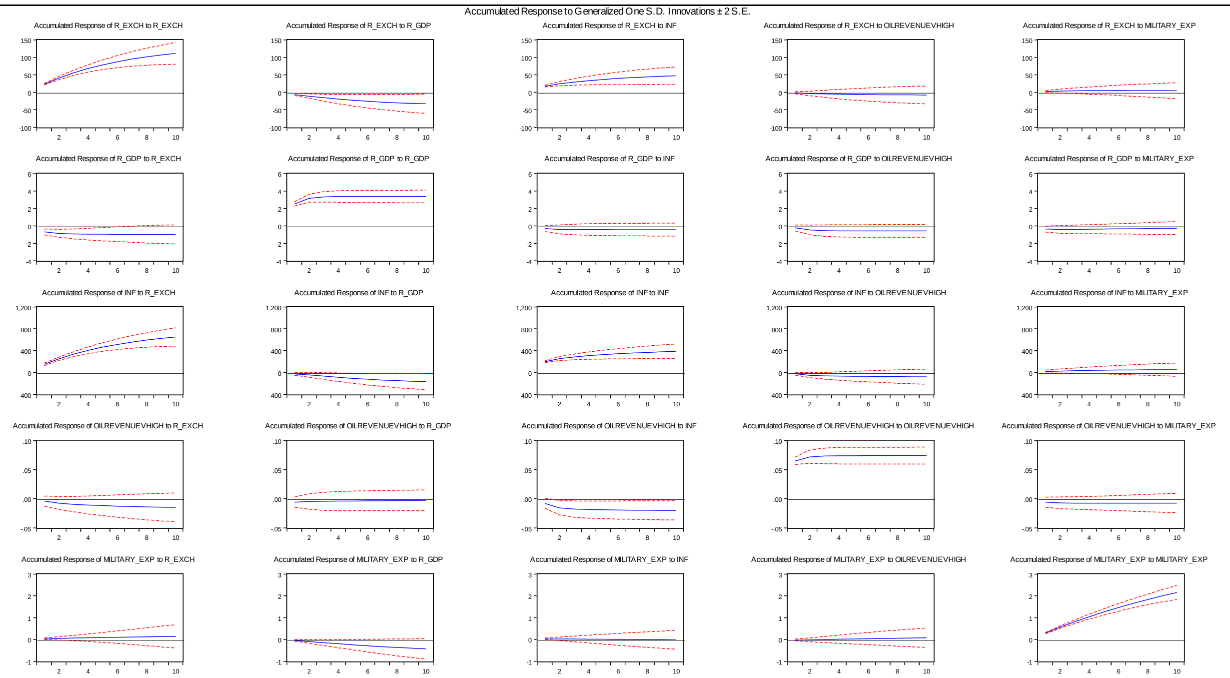
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, EDUCATION_EXP= education expenditure

Appendix C.44. Cumulative generalised impulse responses of oil revenue low volatility on education expenditure in non-OPEC countries



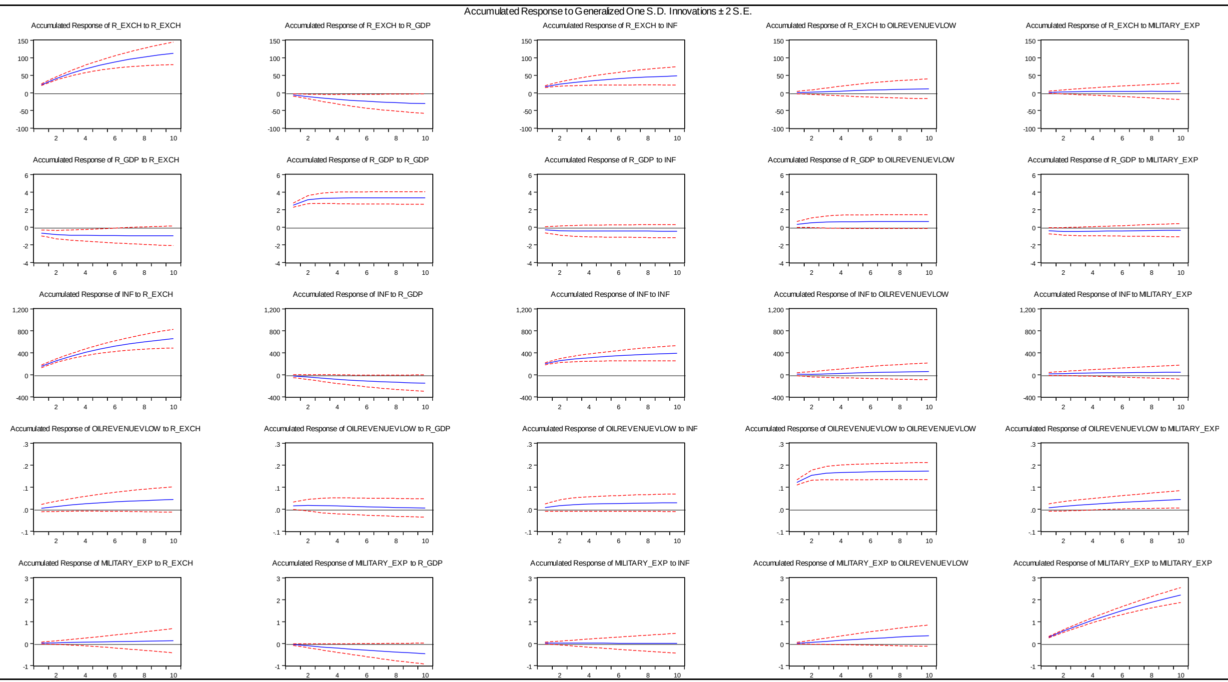
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, EDUCATION_EXP= education expenditure

Appendix C.45. Cumulative generalised impulse responses of oil revenue high volatility on military expenditure in non-OPEC countries



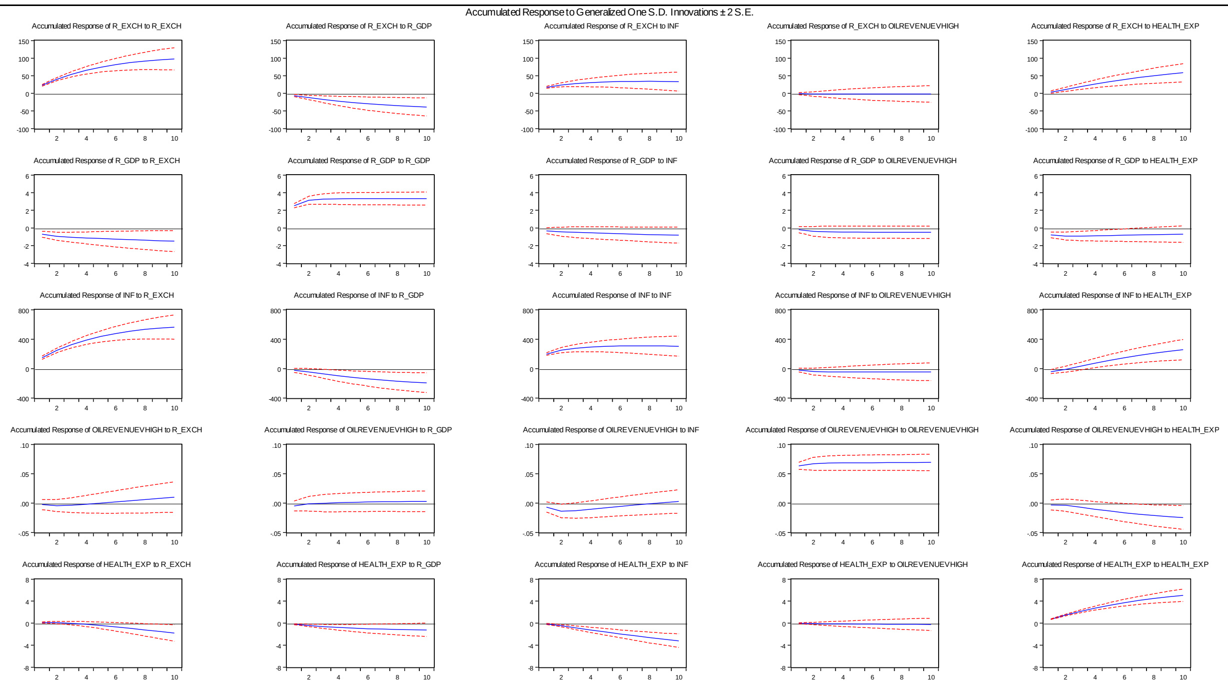
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, MILITARY_EXP= military expenditure

Appendix C.46. Cumulative generalised impulse responses of oil revenue low volatility on military expenditure in OPEC countries



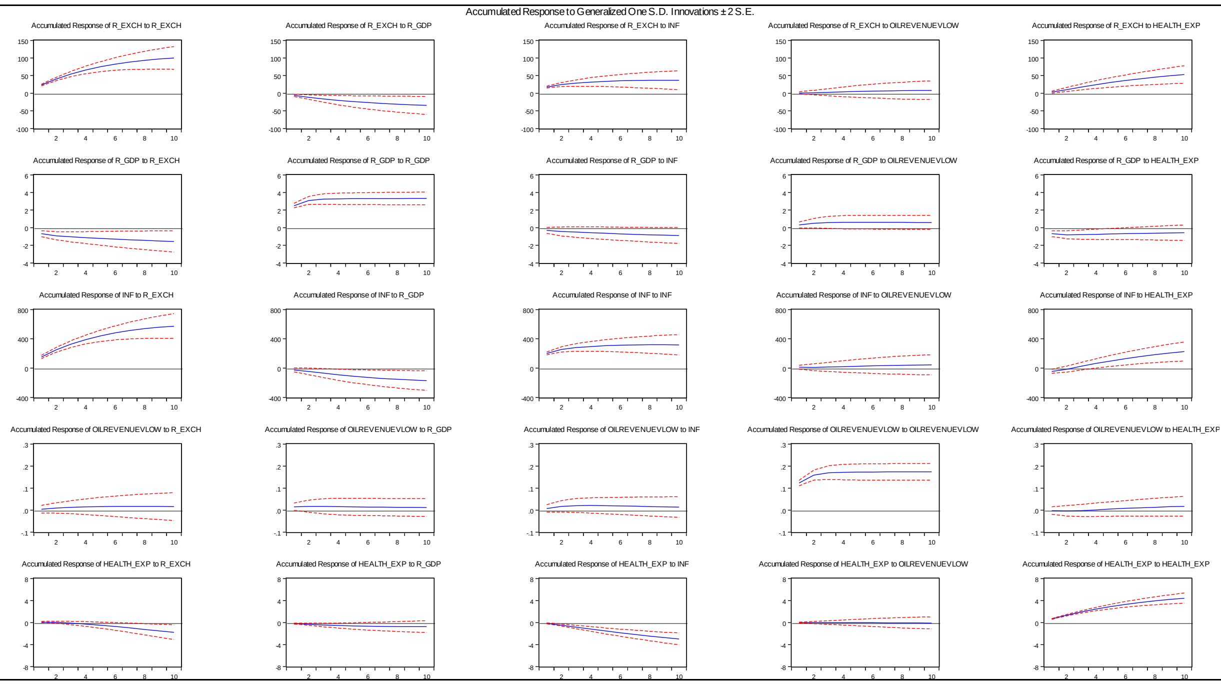
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, MILITARY_EXP= military expenditure

Appendix C.47. Cumulative generalised impulse responses of oil revenue high volatility on health expenditure in non-OPEC countries



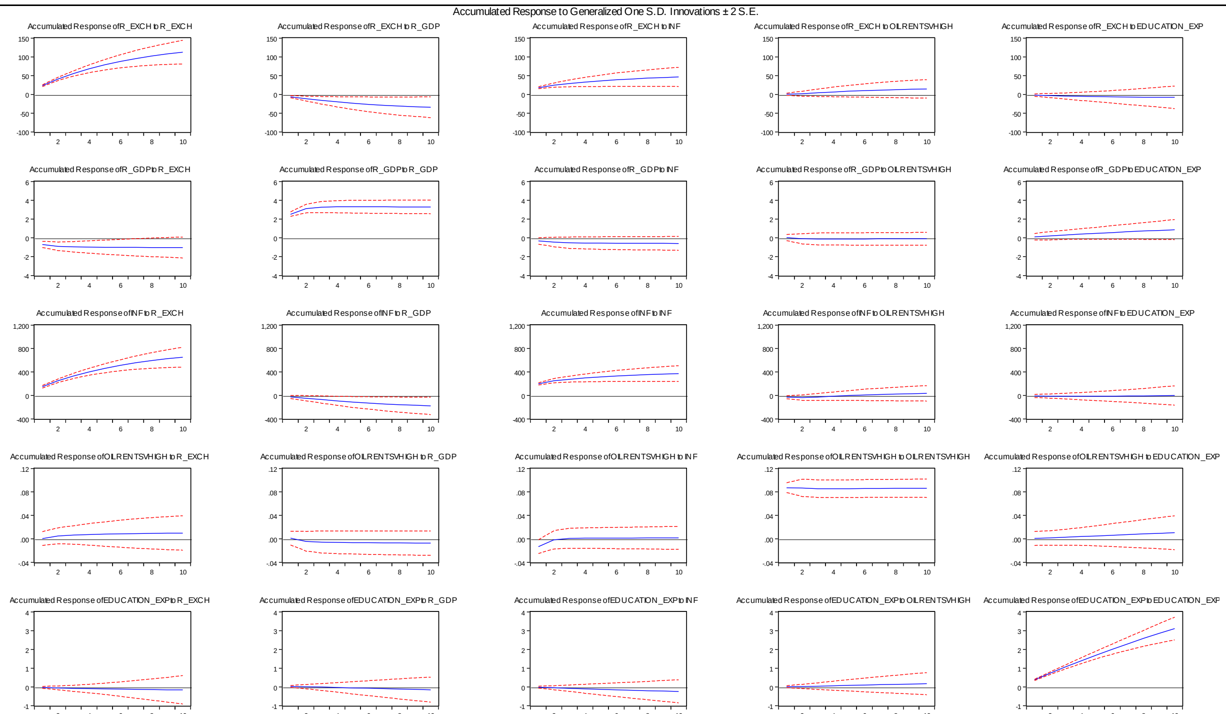
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVHIGH= oil revenue high volatility, HEALTH_EXP= health expenditure

Appendix C.48. Cumulative generalised impulse responses of oil revenue low volatility on health expenditure in OPEC countries



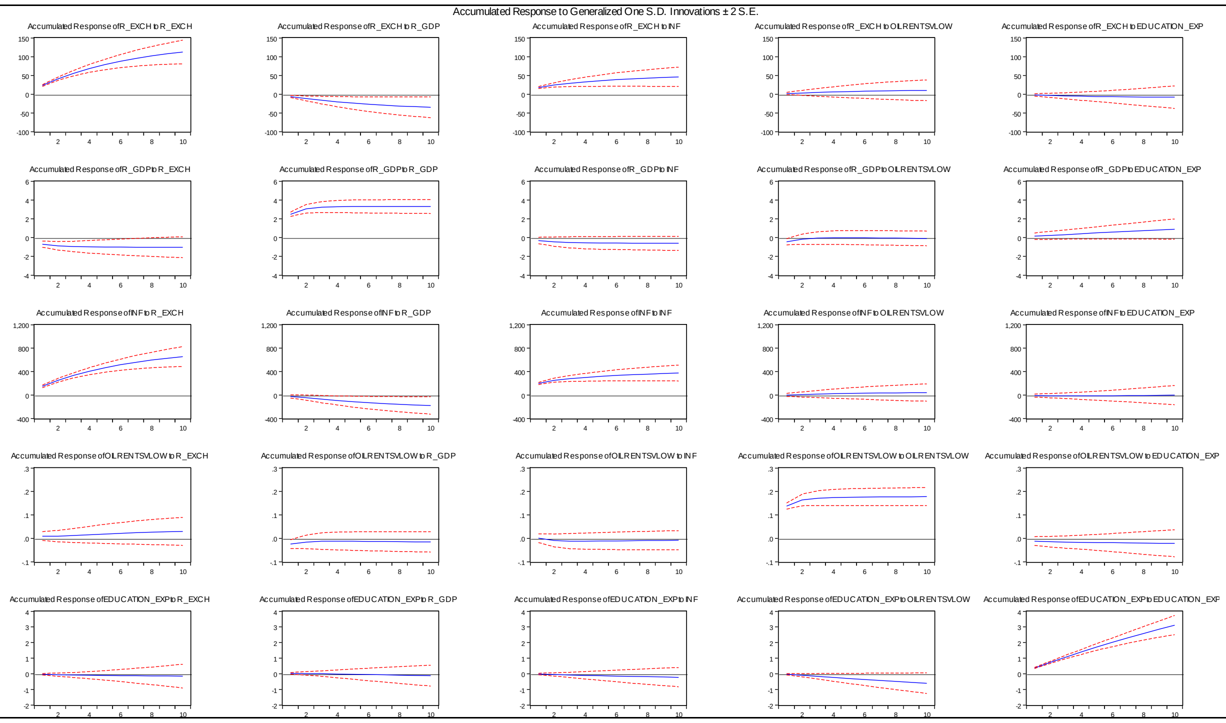
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILREVENUEVLOW= oil revenue low volatility, HEALTH_EXP= health expenditure

Appendix C.49. Cumulative generalised impulse responses of oil rent high volatility on education expenditure in non-OPEC countries



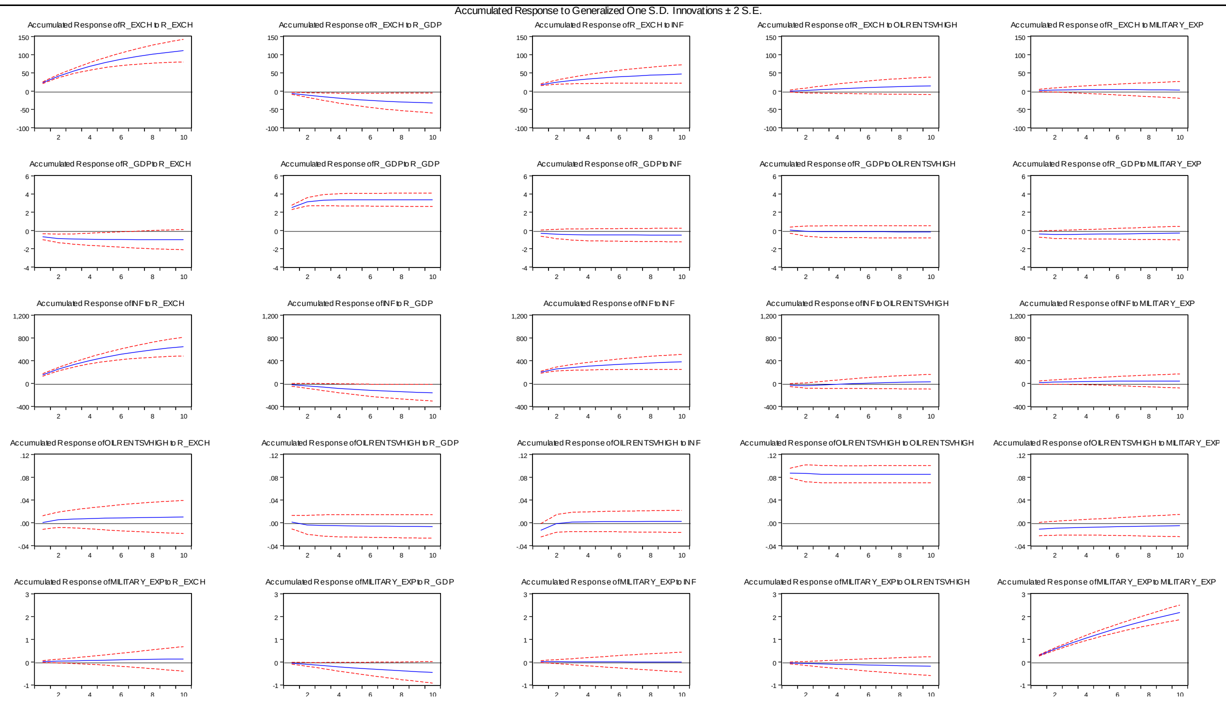
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, EDUCATION_EXP= education expenditure

Appendix C.50. Cumulative generalised impulse responses of oil rent low volatility on education expenditure in non-OPEC countries



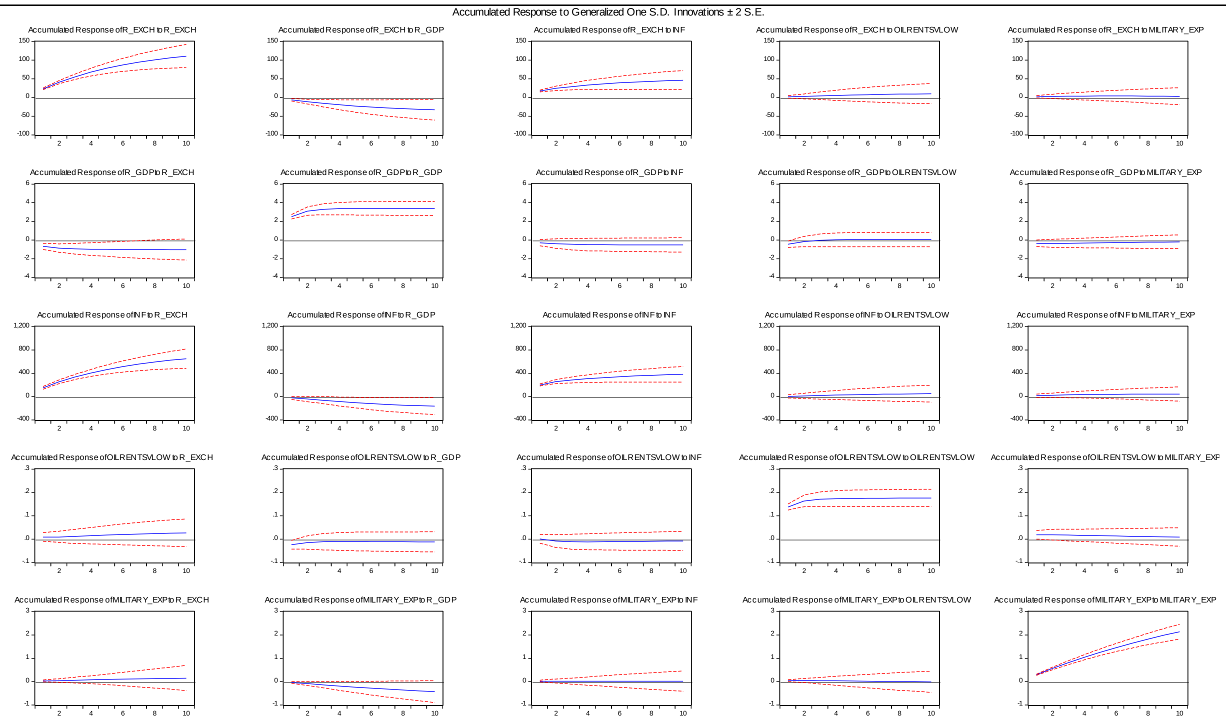
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, EDUCATION_EXP= education expenditure

Appendix C.51. Cumulative generalised impulse responses of oil rent high volatility on military expenditure in non-OPEC countries



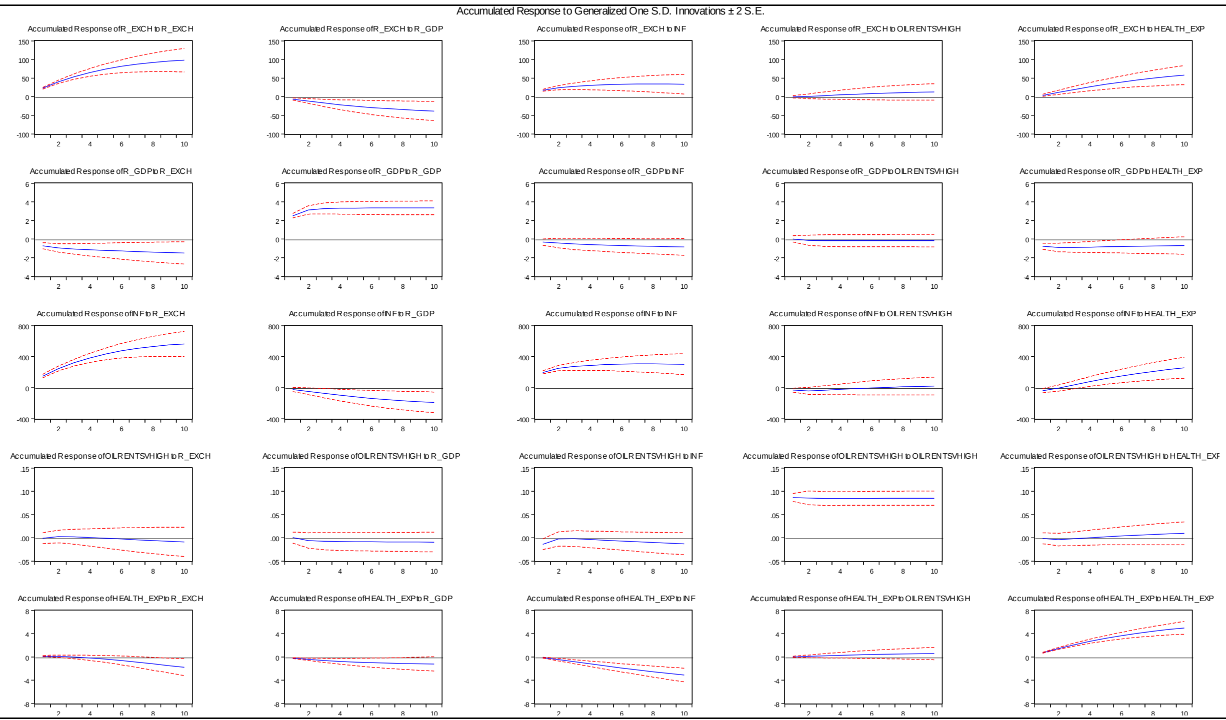
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, MILITARY_EXP= military expenditure

Appendix C.52. Cumulative generalised impulse responses of oil rent low volatility on military expenditure in non-OPEC countries



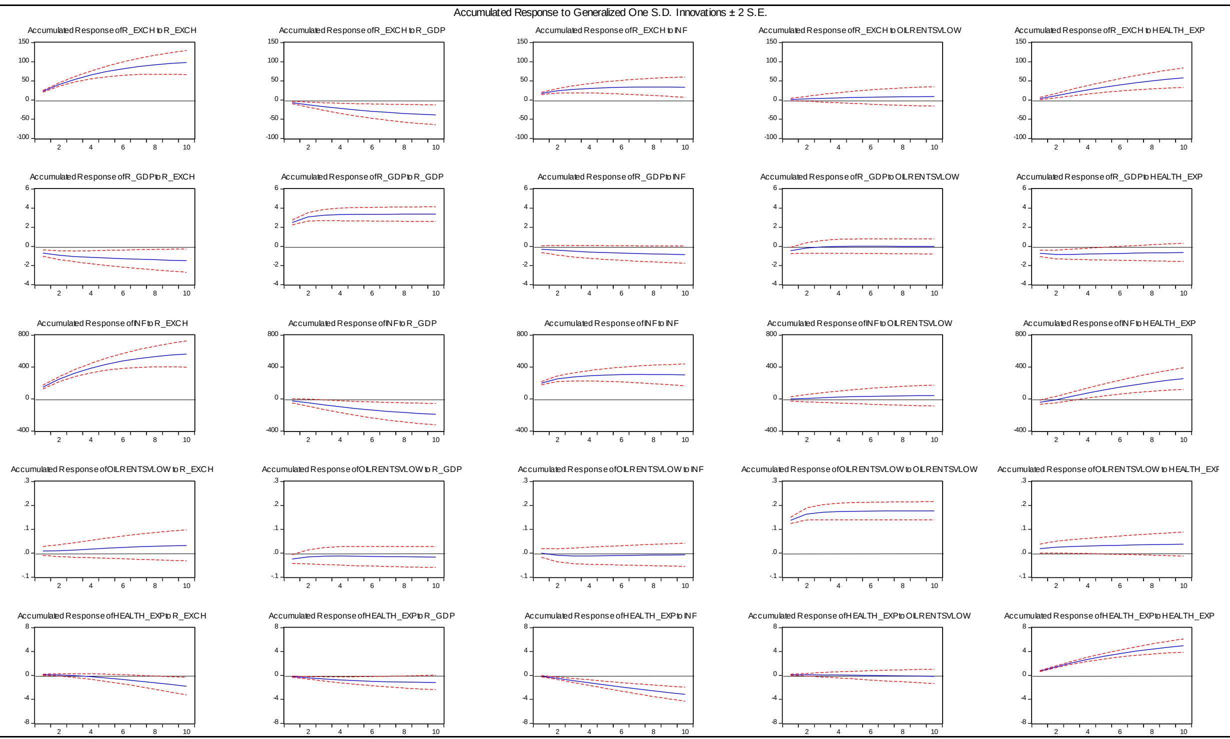
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, MILITARY_EXP= military expenditure

Appendix C.53. Cumulative generalised impulse responses of oil rent high volatility on health expenditure in non-OPEC countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVHIGH= oil rents high volatility, HEALTH_EXP= health expenditure

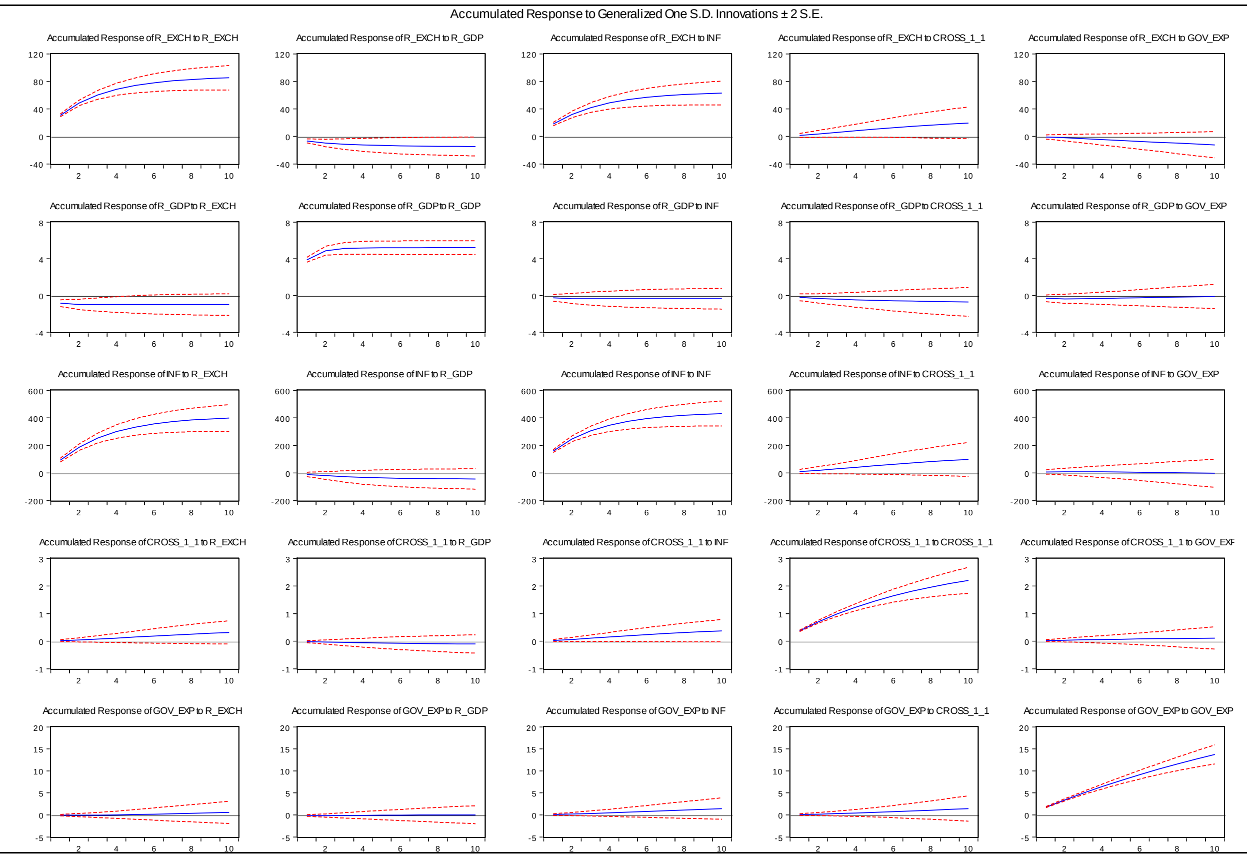
Appendix C.54. Cumulative generalised impulse responses of oil rent low volatility on health expenditure in non-OPEC countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, OILRENTSVLOW= oil rents low volatility, HEALTH_EXP= health expenditure

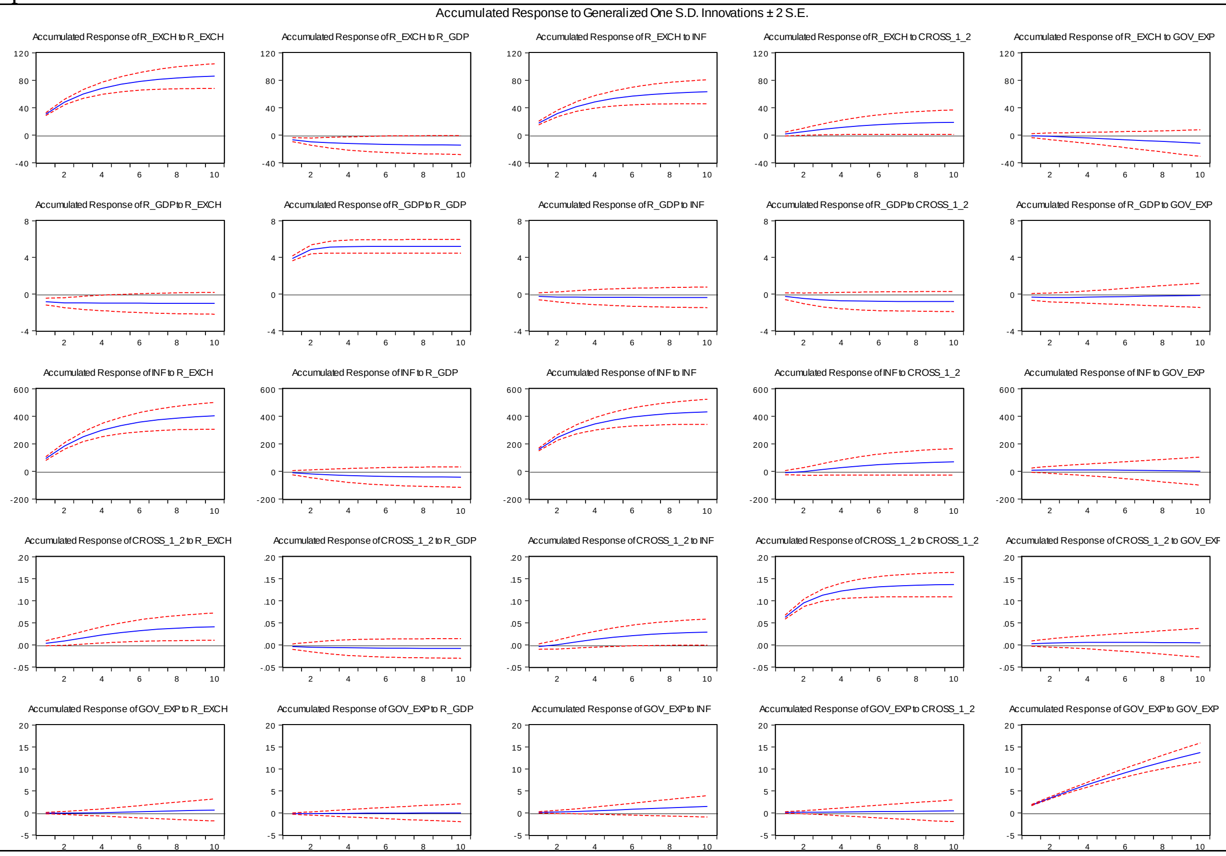
Appendix D: The dynamic impact among oil volatility, the quality of political institutions, and government spending

Appendix D.1. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on government expenditure in Democratic countries



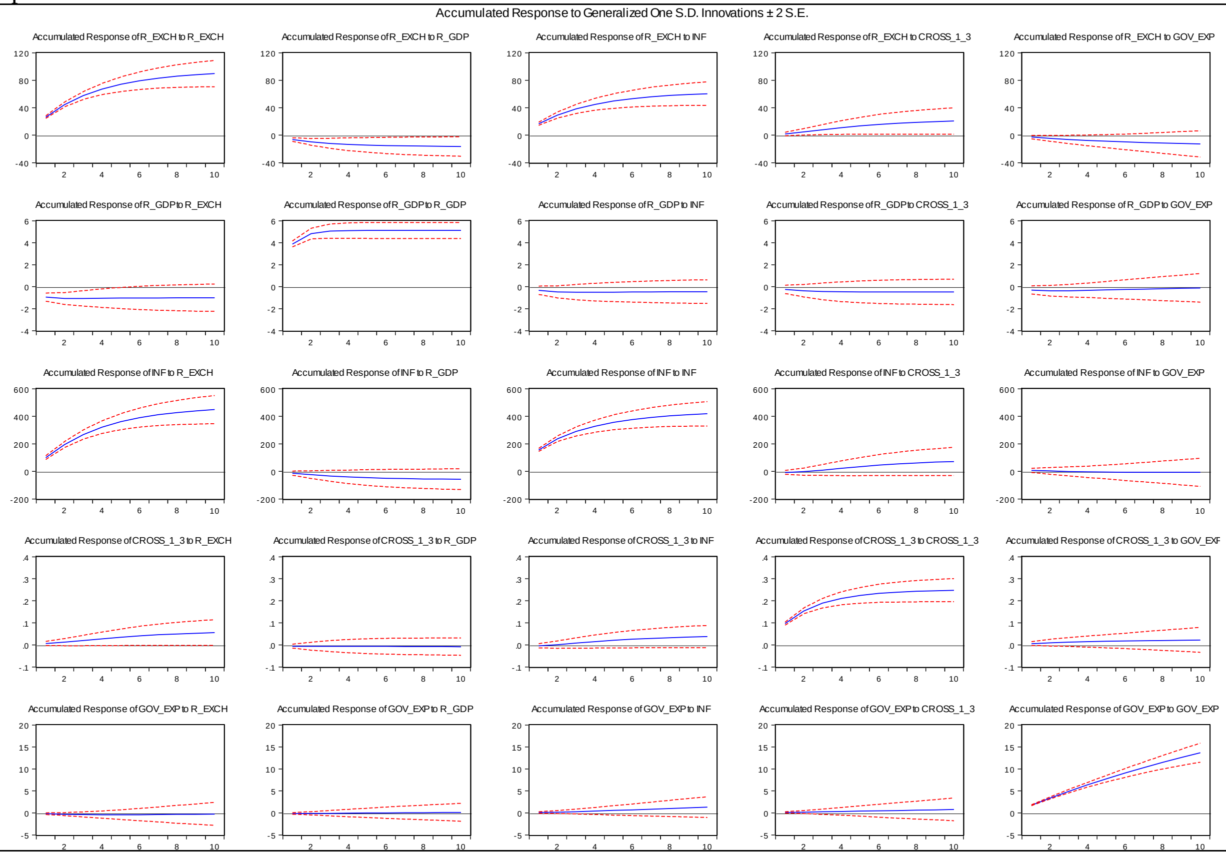
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, GOV_EXP= government expenditure

Appendix D.2. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on government expenditure in Democratic countries



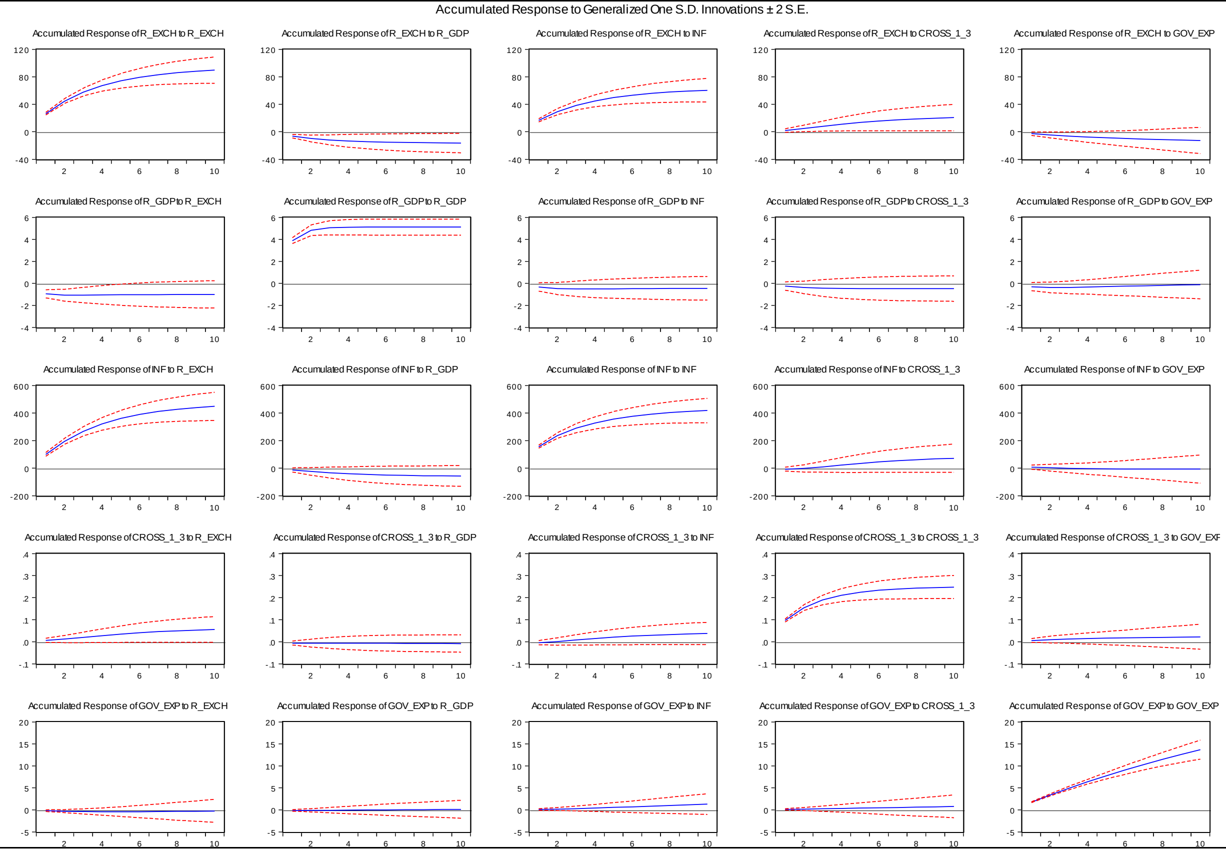
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, GOV_EXP= government expenditure

Appendix D.3. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on government expenditure in Democratic countries



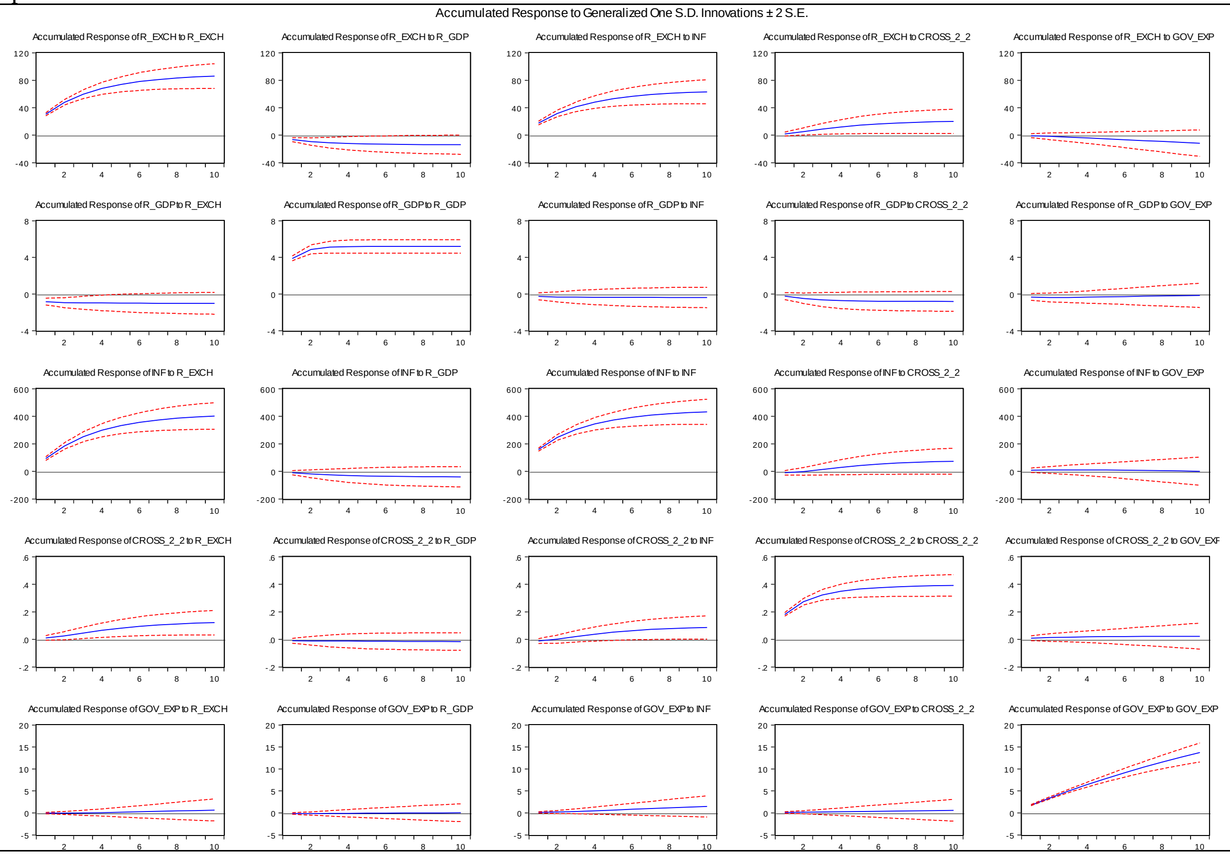
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, GOV_EXP= government expenditure

Appendix D.4. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on government expenditure in Democratic countries



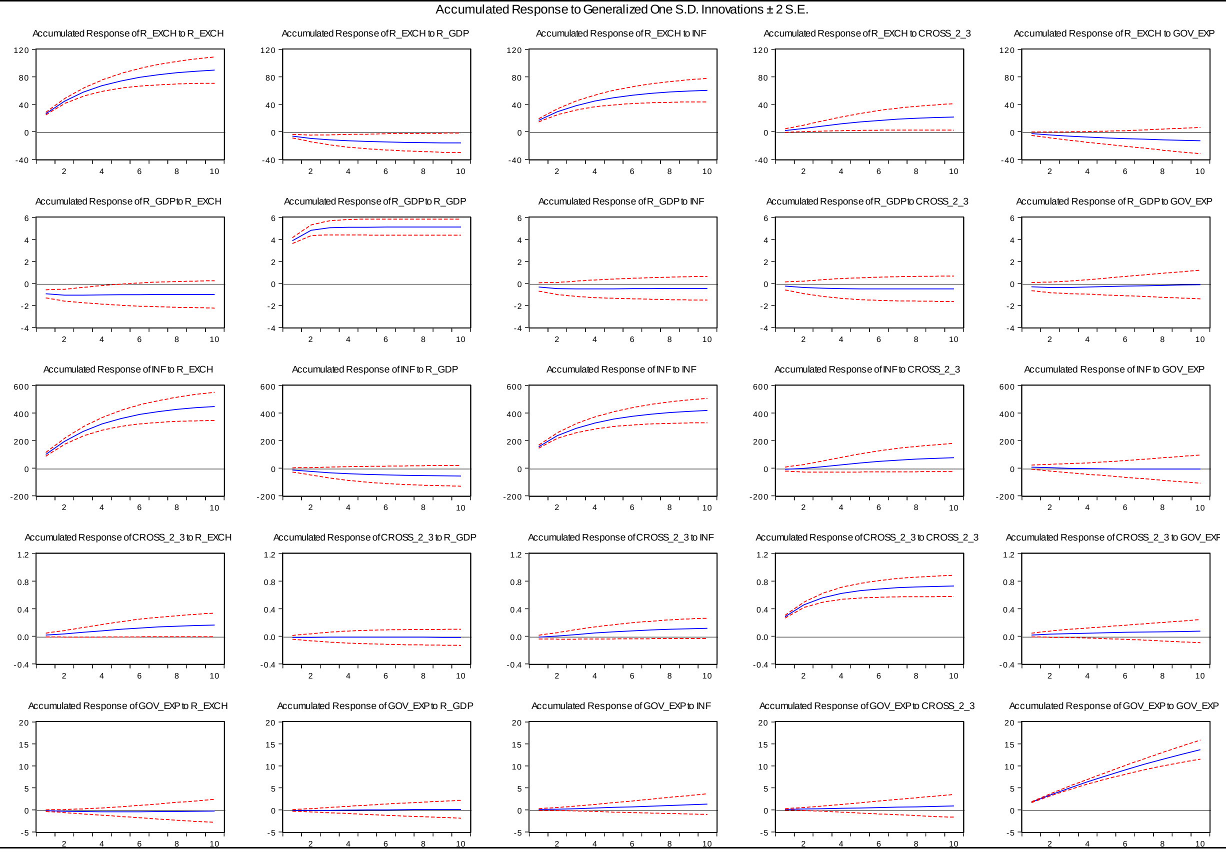
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut0dem1xrreg), GOV_EXP= government expenditure

Appendix D.5. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on government expenditure in Democratic countries



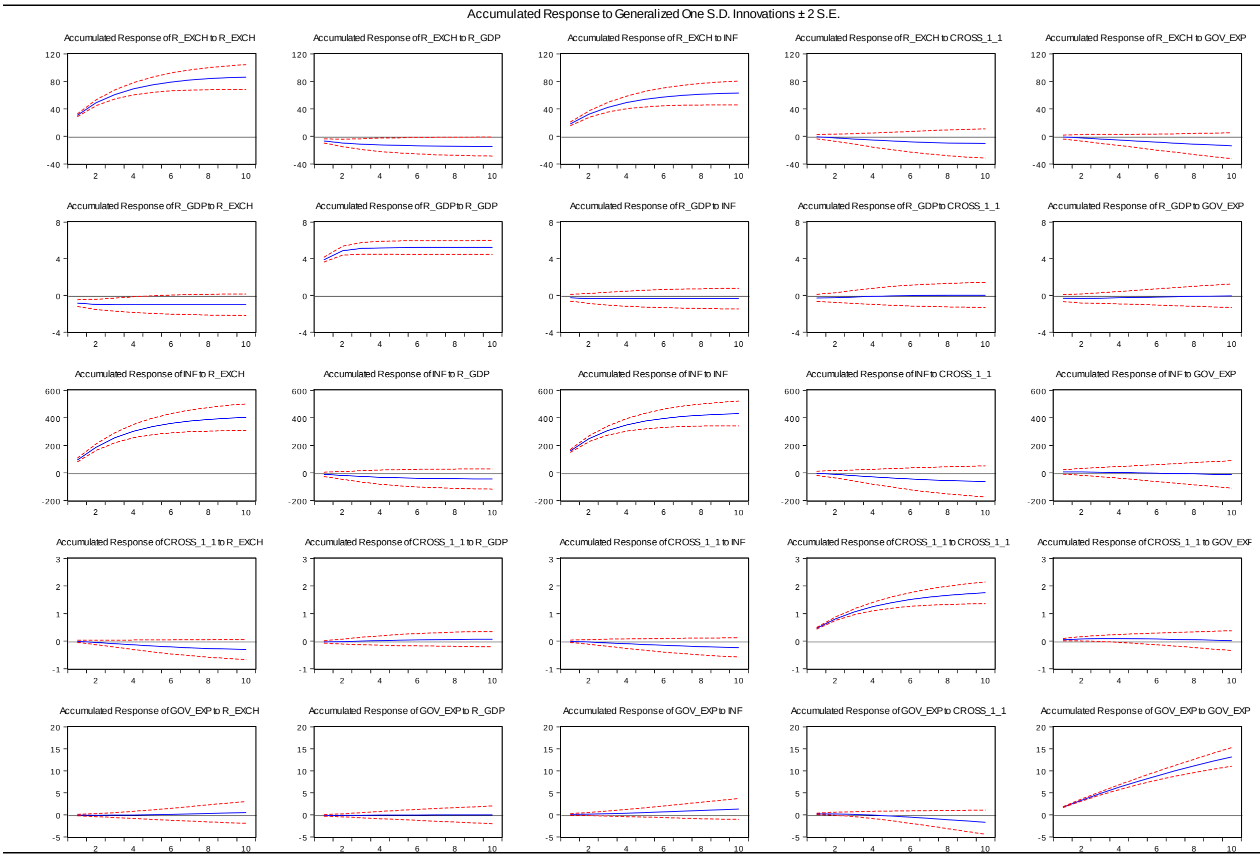
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut0dem1xrreg), GOV_EXP= government expenditure

Appendix D.6. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on government expenditure in Democratic countries



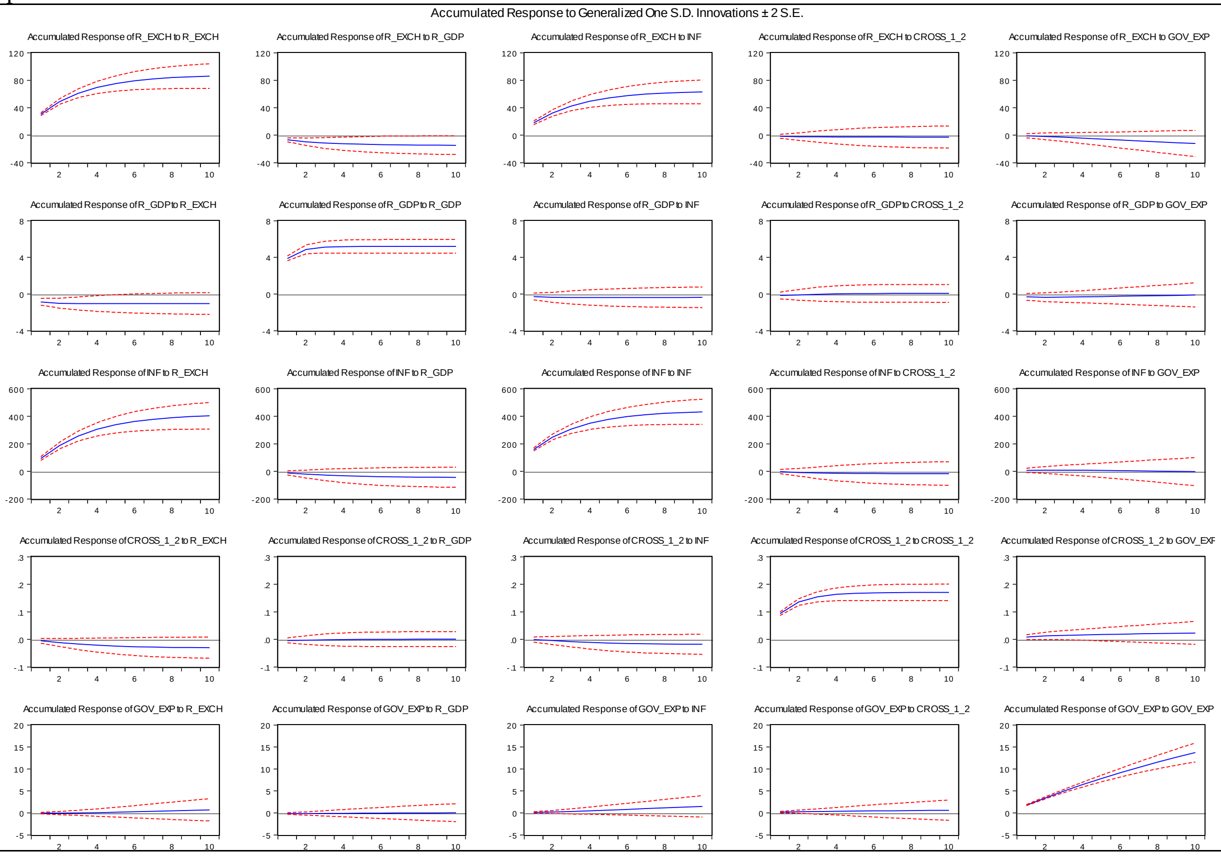
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut0dem1xrreg), GOV_EXP= government expenditure

Appendix D.7. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on government expenditure in Non-democratic countries



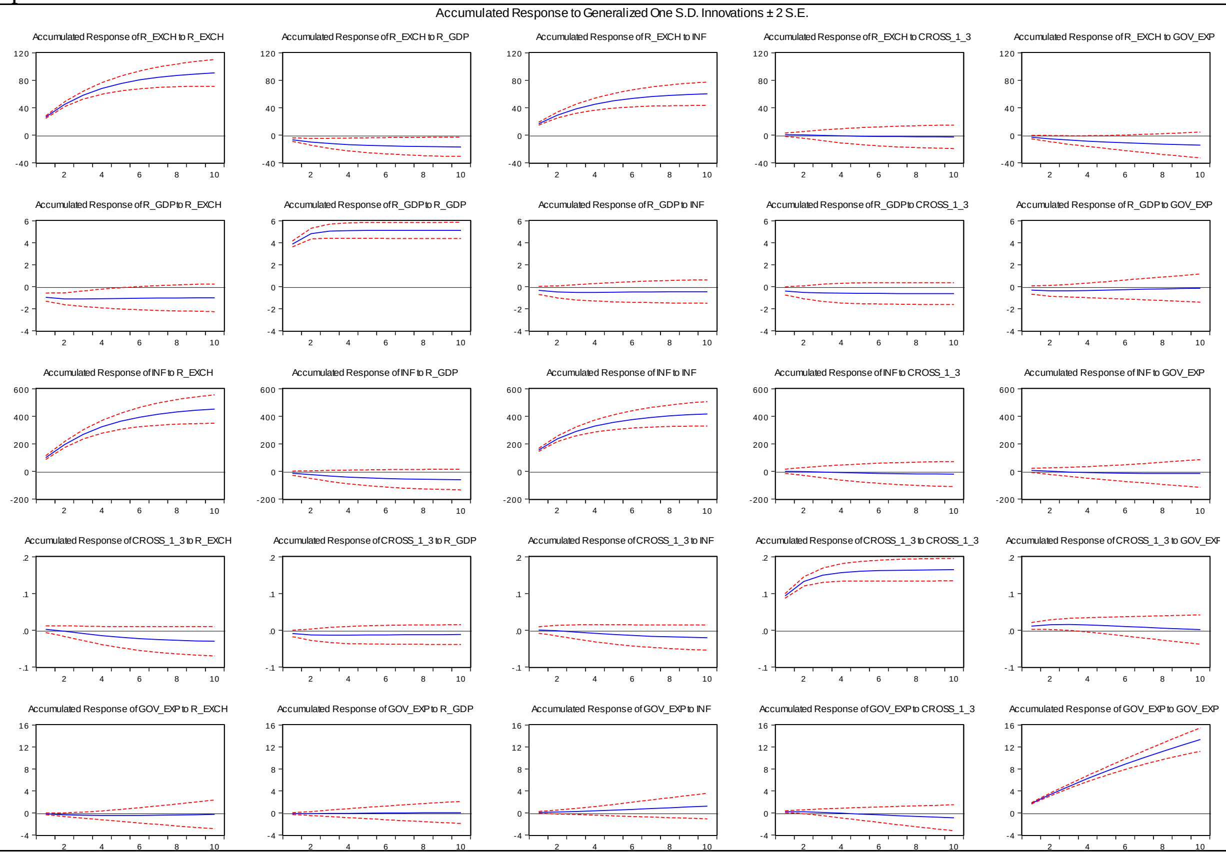
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, GOV_EXP= government expenditure

Appendix D.8. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on government expenditure in non-Democratic countries



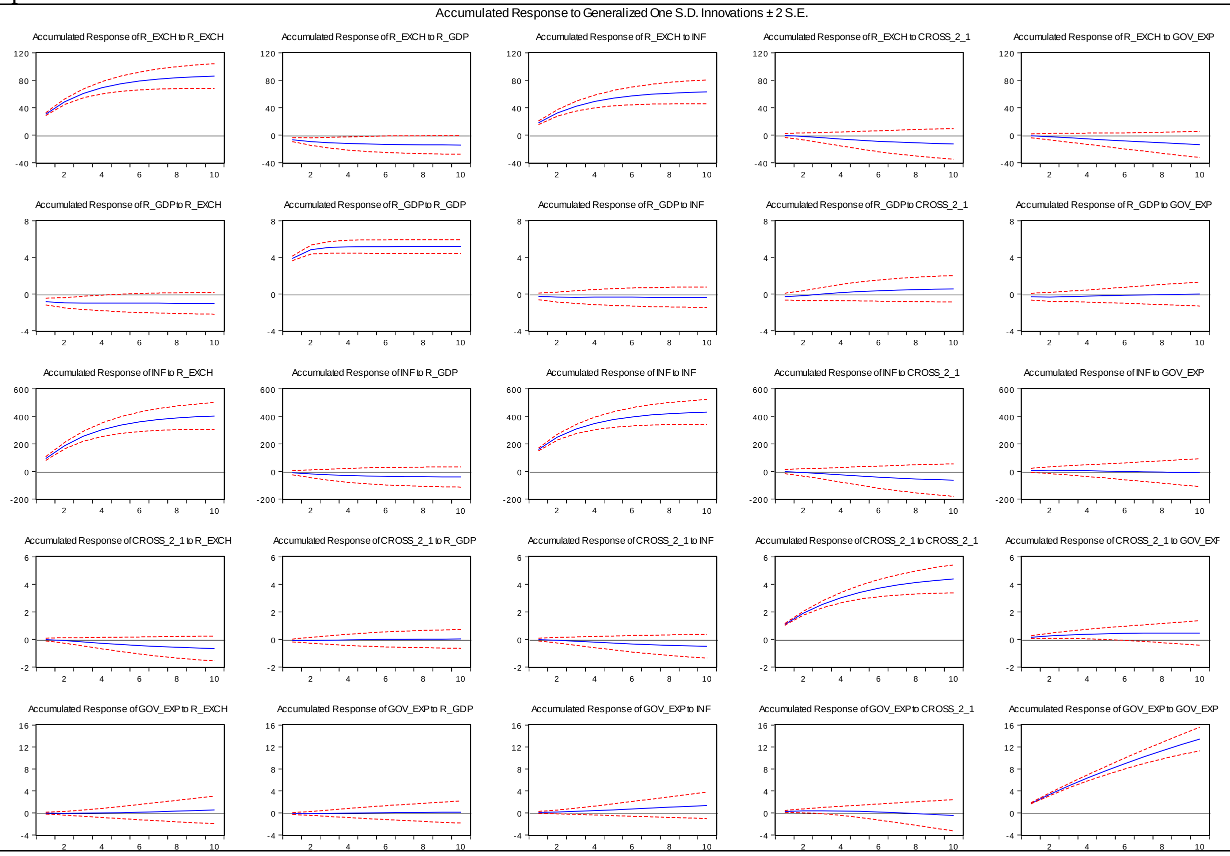
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, GOV_EXP= government expenditure

Appendix D.9. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on government expenditure in non-Democratic countries



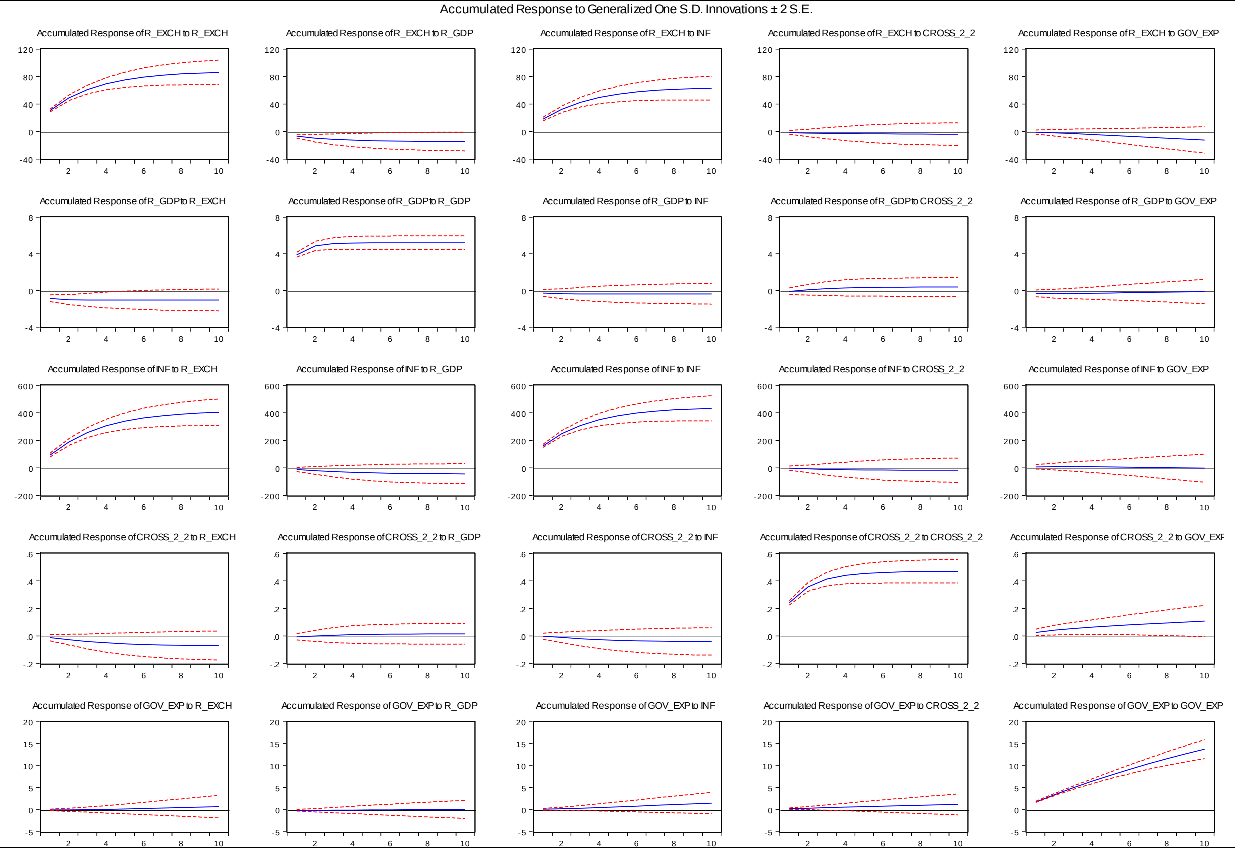
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut1dem0, GOV_EXP= government expenditure

Appendix D.10. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on government expenditure in Non-Democratic countries



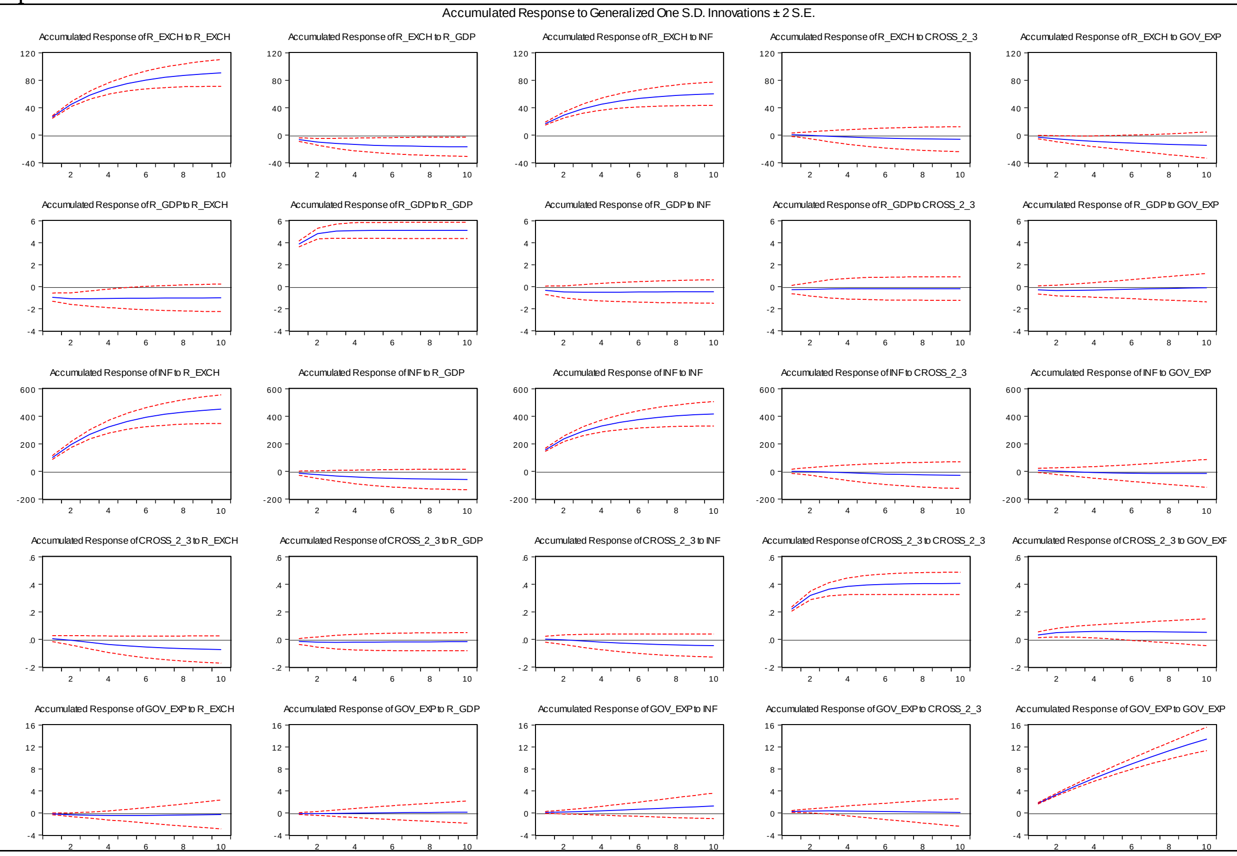
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut1dem0xrreg), GOV_EXP= government expenditure

Appendix D.11. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on government expenditure in non-Democratic countries



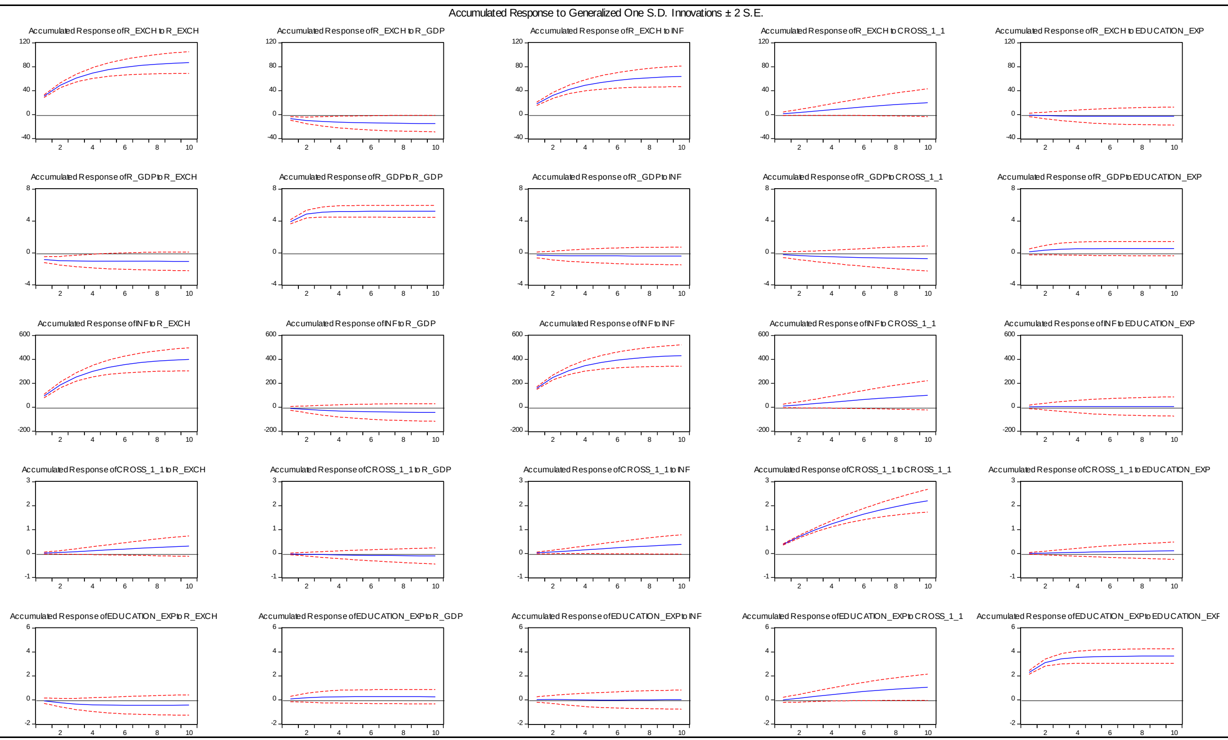
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut1dem0xrreg), GOV_EXP= government expenditure

Appendix D.12. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on government expenditure in Non-Democratic countries



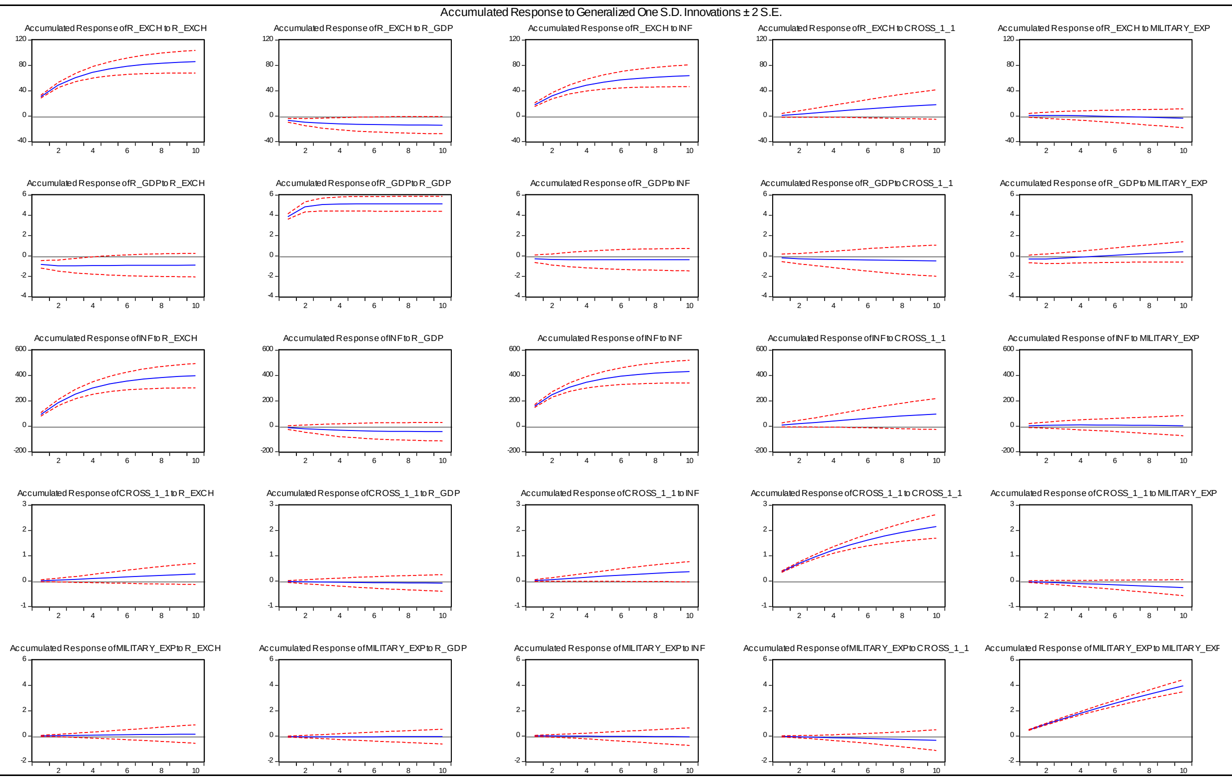
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut1dem0xrreg), GOV_EXP= government expenditure

Appendix D.13. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on education expenditure in Democratic countries



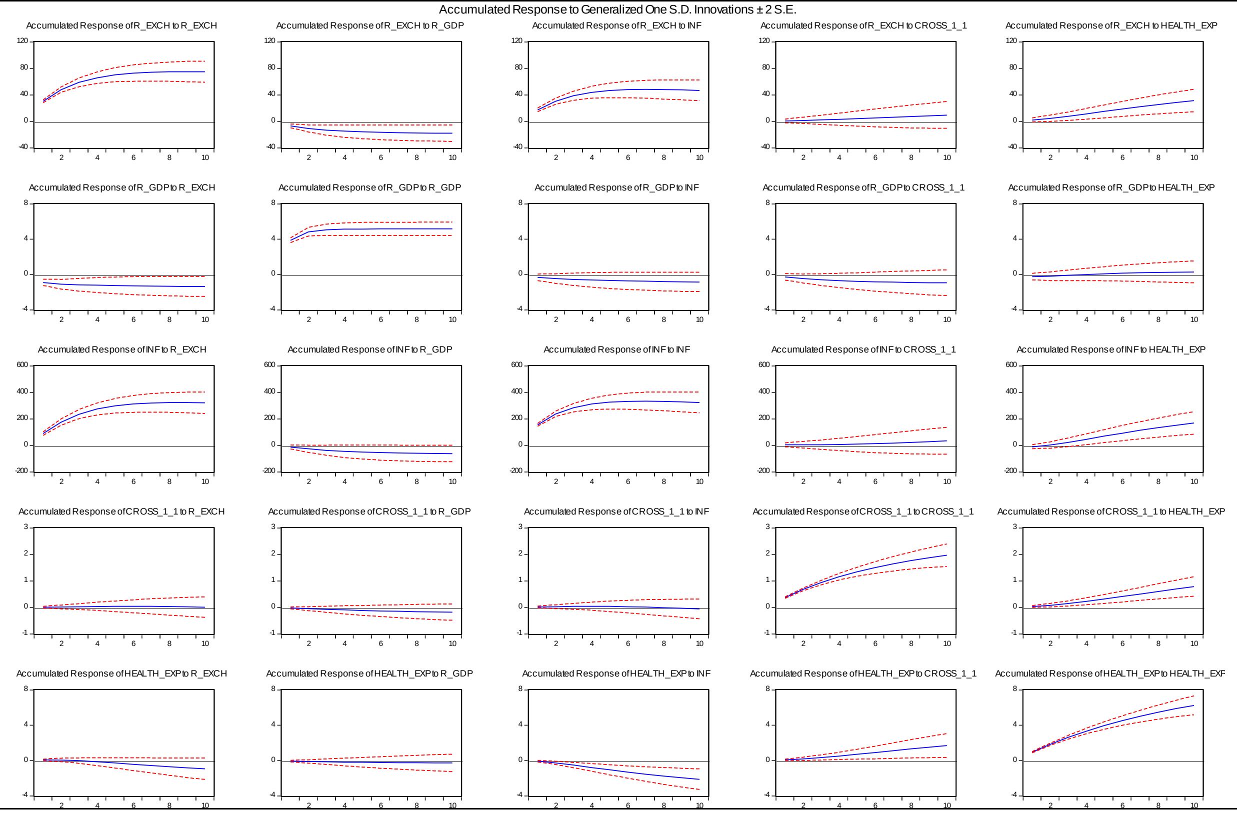
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, EDUCATION_EXP= education expenditure

Appendix D.14. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on military expenditure in Democratic countries



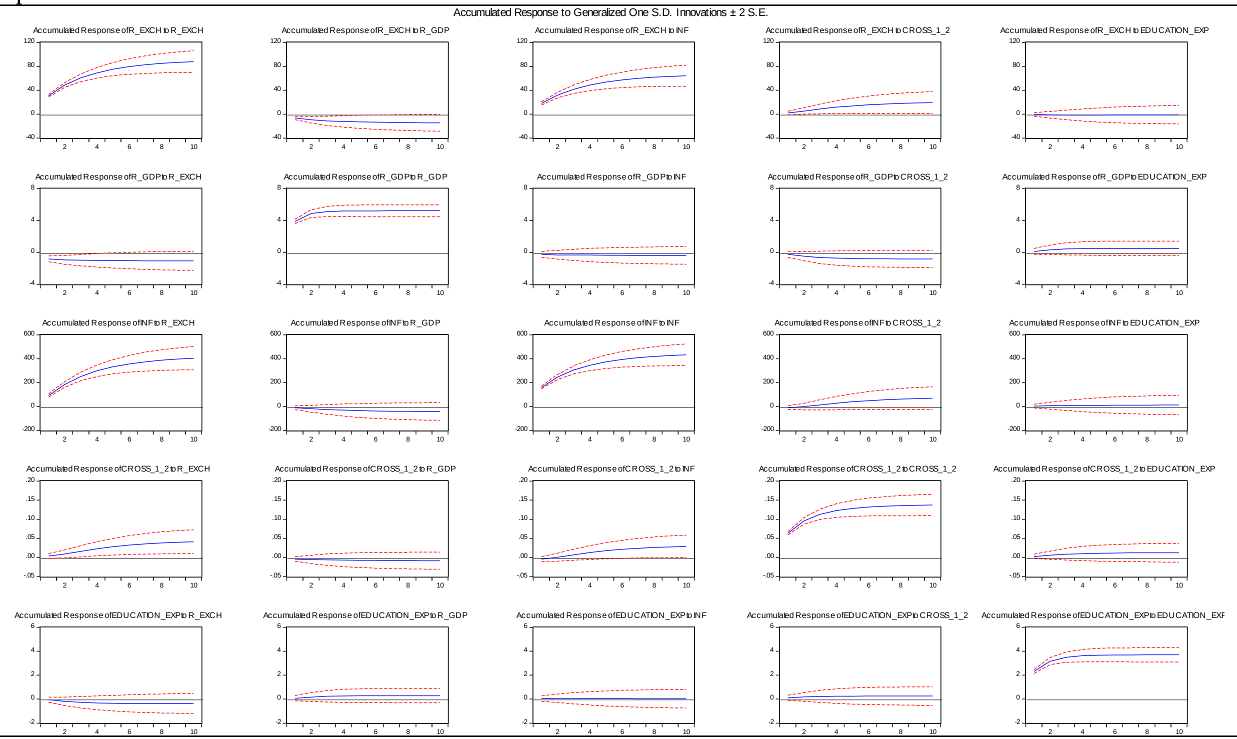
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, MILITARY_EXP= military expenditure

Appendix D.15. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on health expenditure in Democratic countries



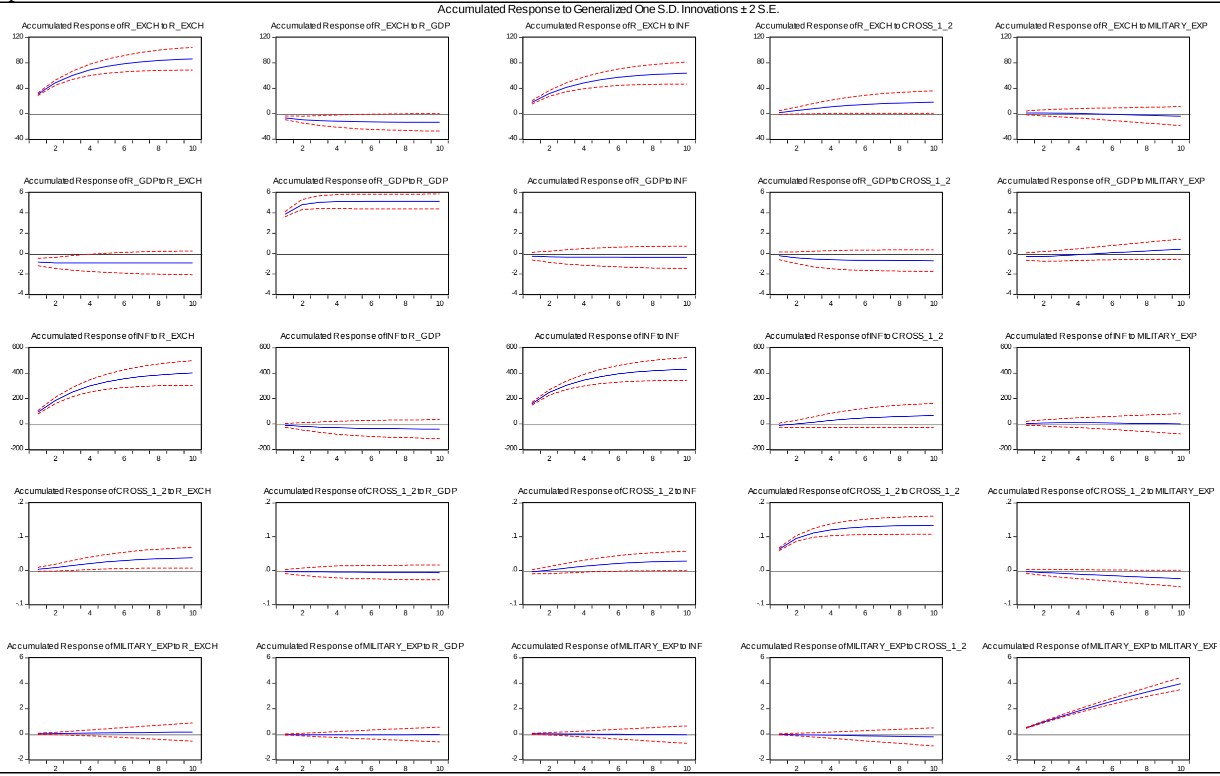
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut0dem1, HEALTH_EXP= health expenditure

Appendix D.16. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on education expenditure in Democratic countries



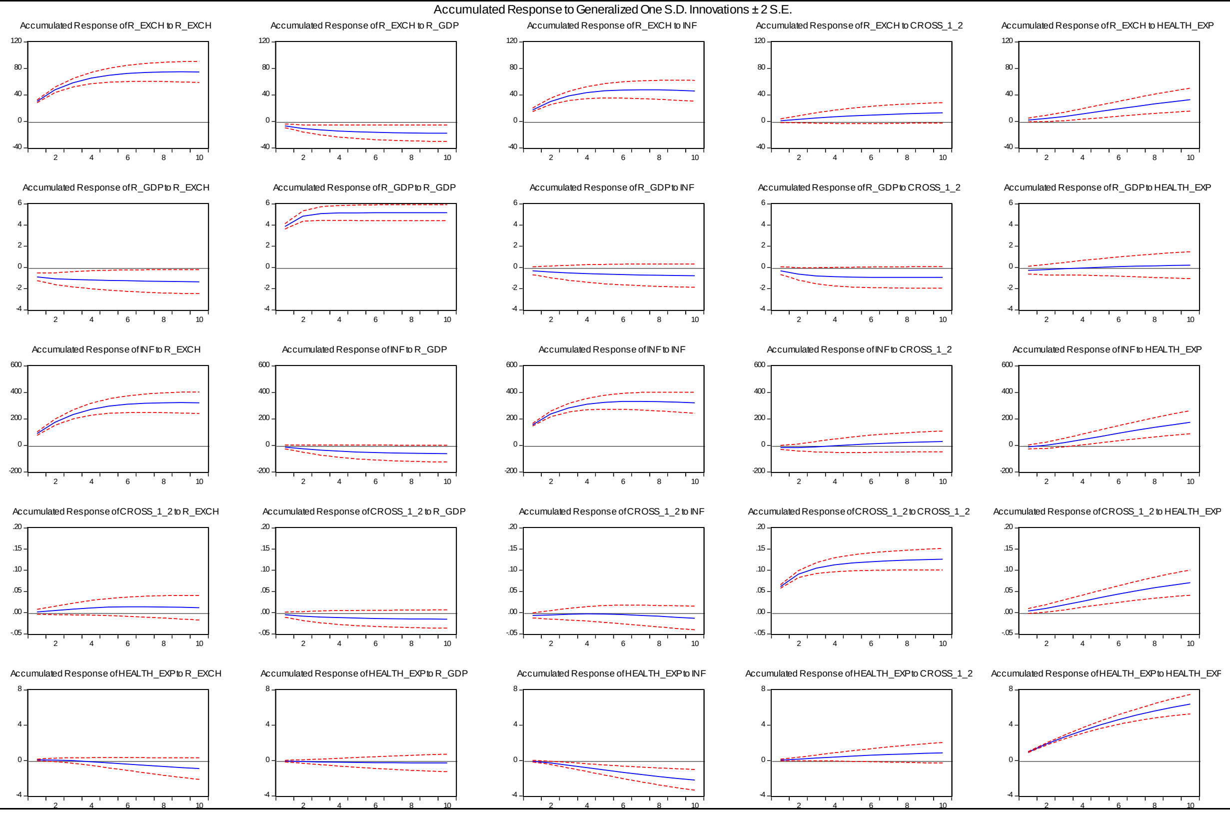
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, EDUCATION_EXP= education expenditure

Appendix D.17. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on military expenditure in Democratic countries



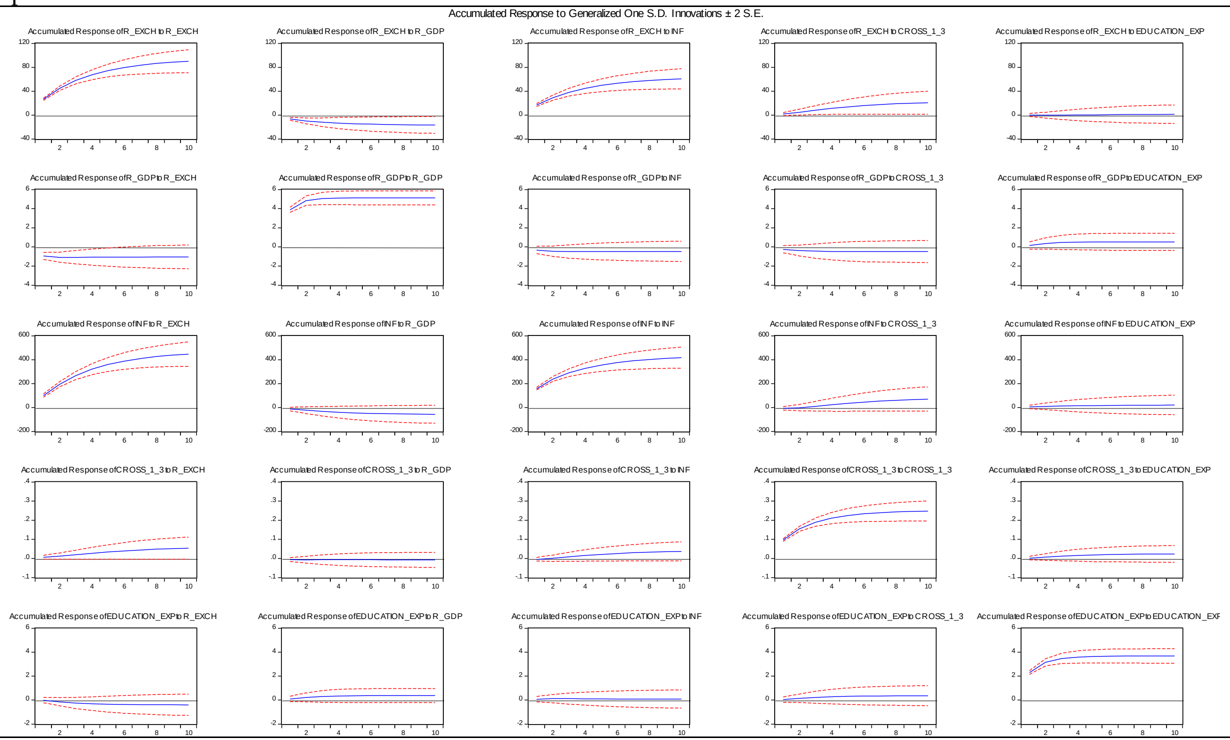
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, MILITARY_EXP= military expenditure

Appendix D.18. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on health expenditure in Democratic countries



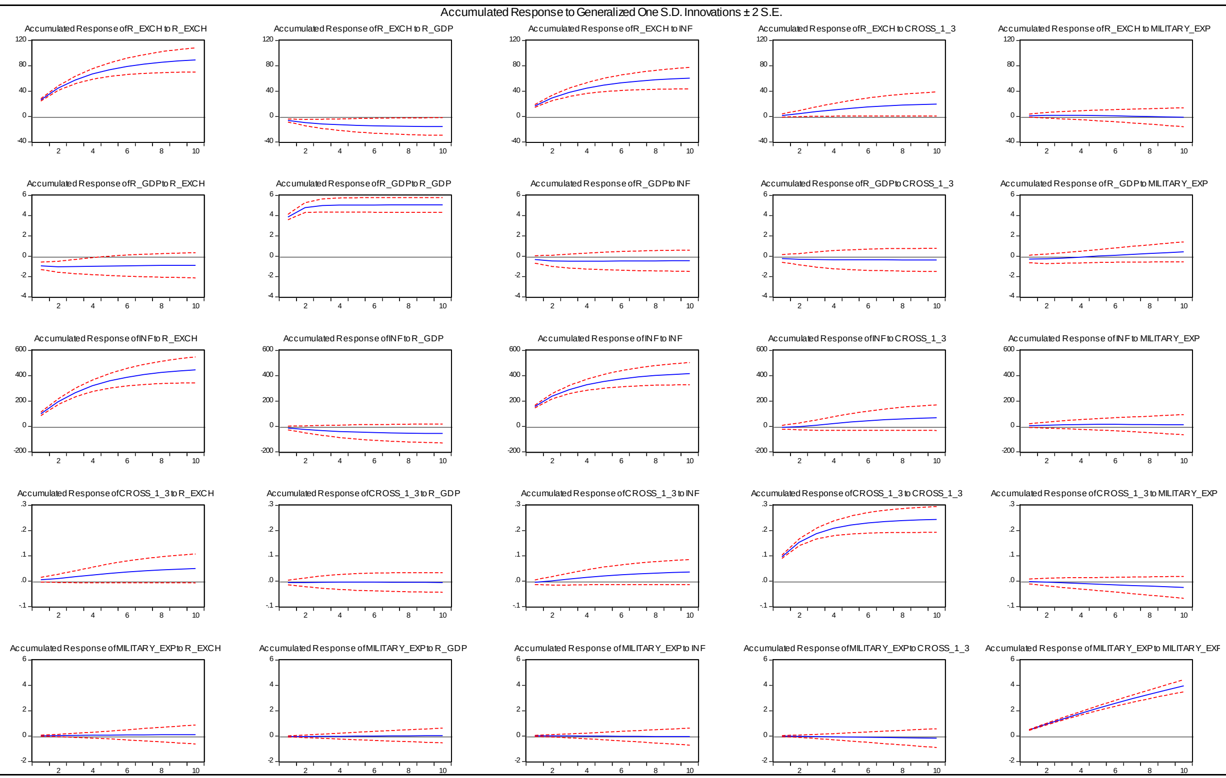
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut0dem1, HEALTH_EXP= health expenditure

Appendix D.19. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on education expenditure in Democratic countries



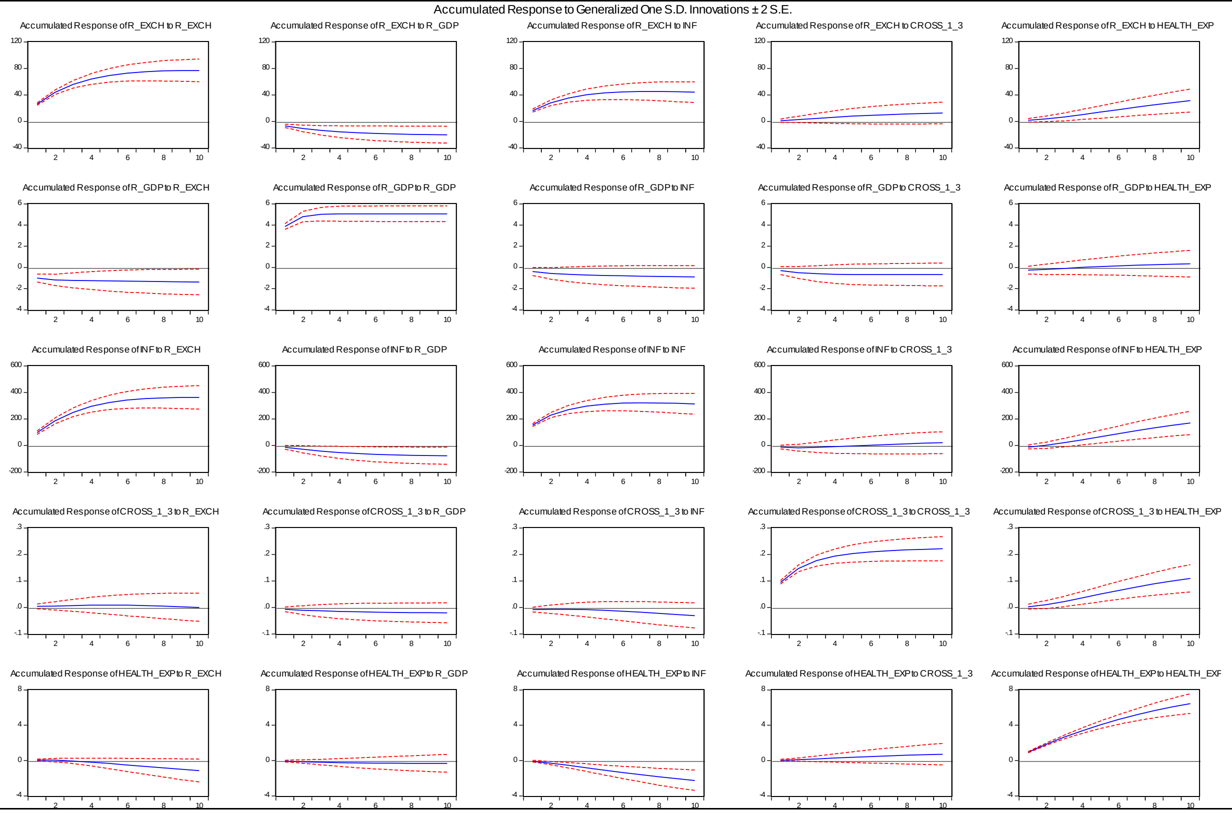
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, EDUCATION_EXP= education expenditure

Appendix 8.20. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on military spending in Democratic countries



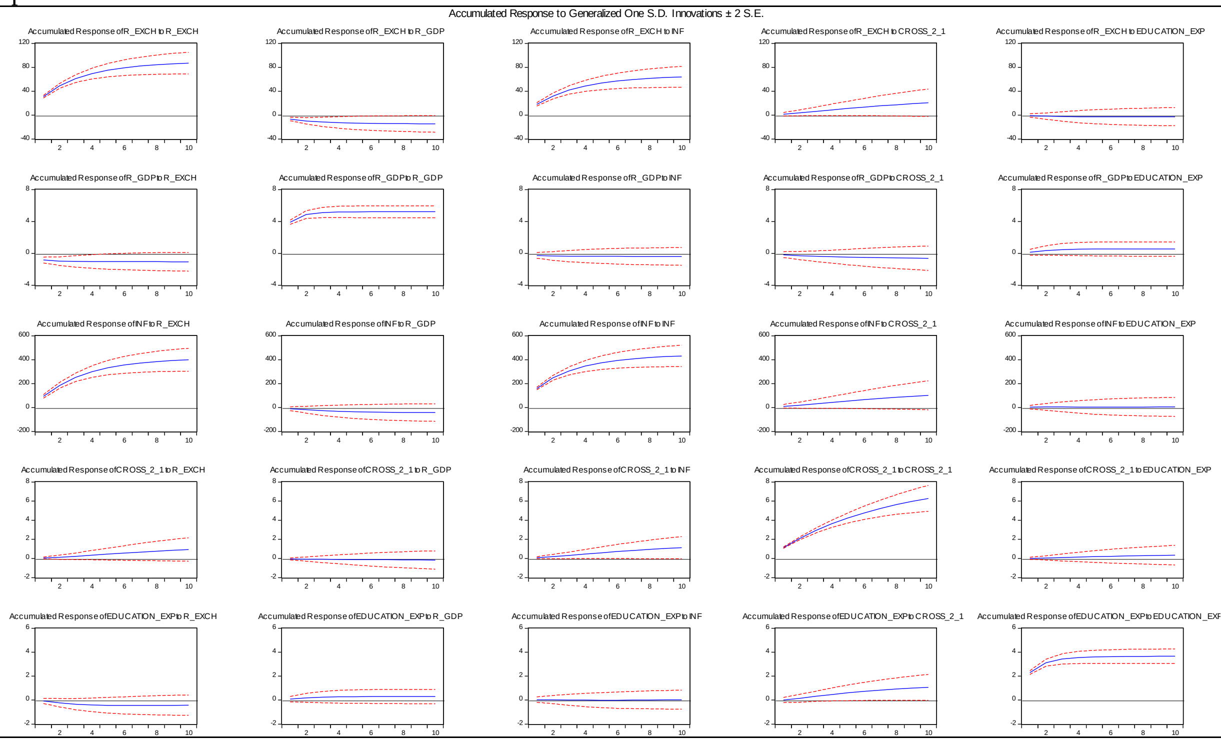
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, MILITARY_EXP= military spending

Appendix D.21. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on health expenditure in Democratic countries



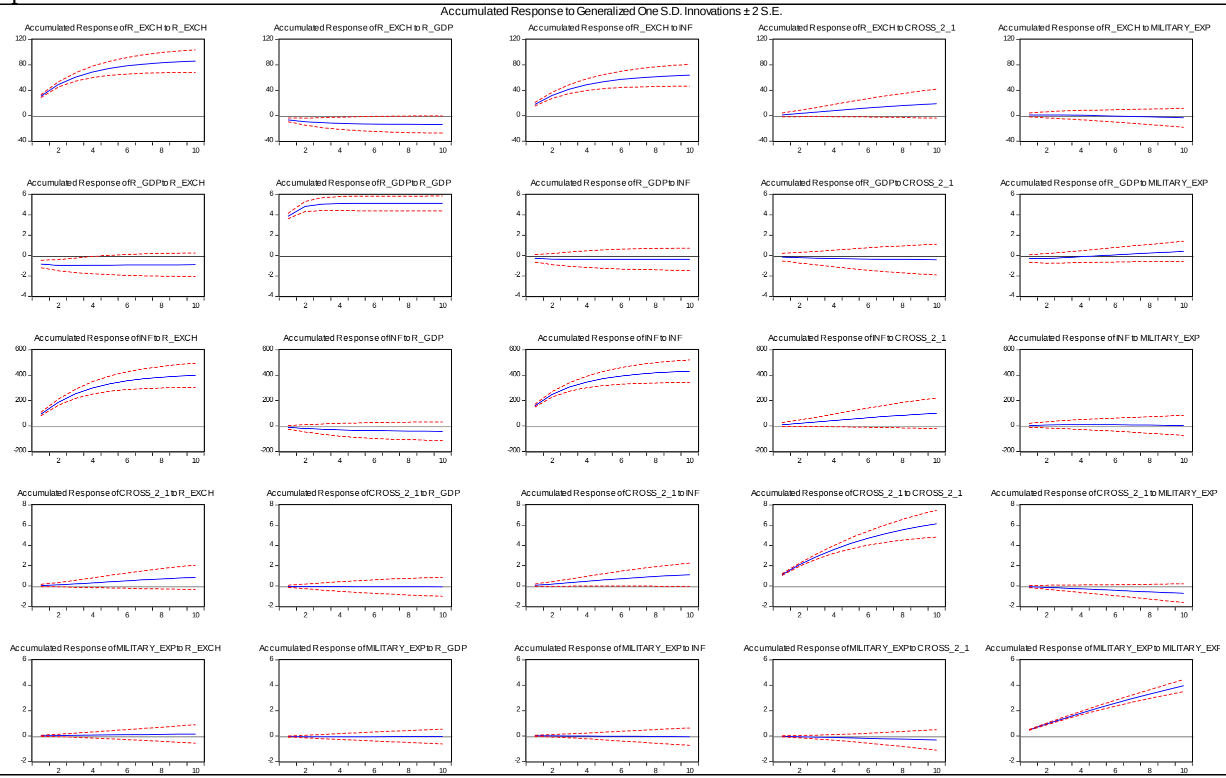
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= OilrentV_aut0dem1, HEALTH_EXP= health expenditure

Appendix D.22. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on education expenditure in Democratic countries



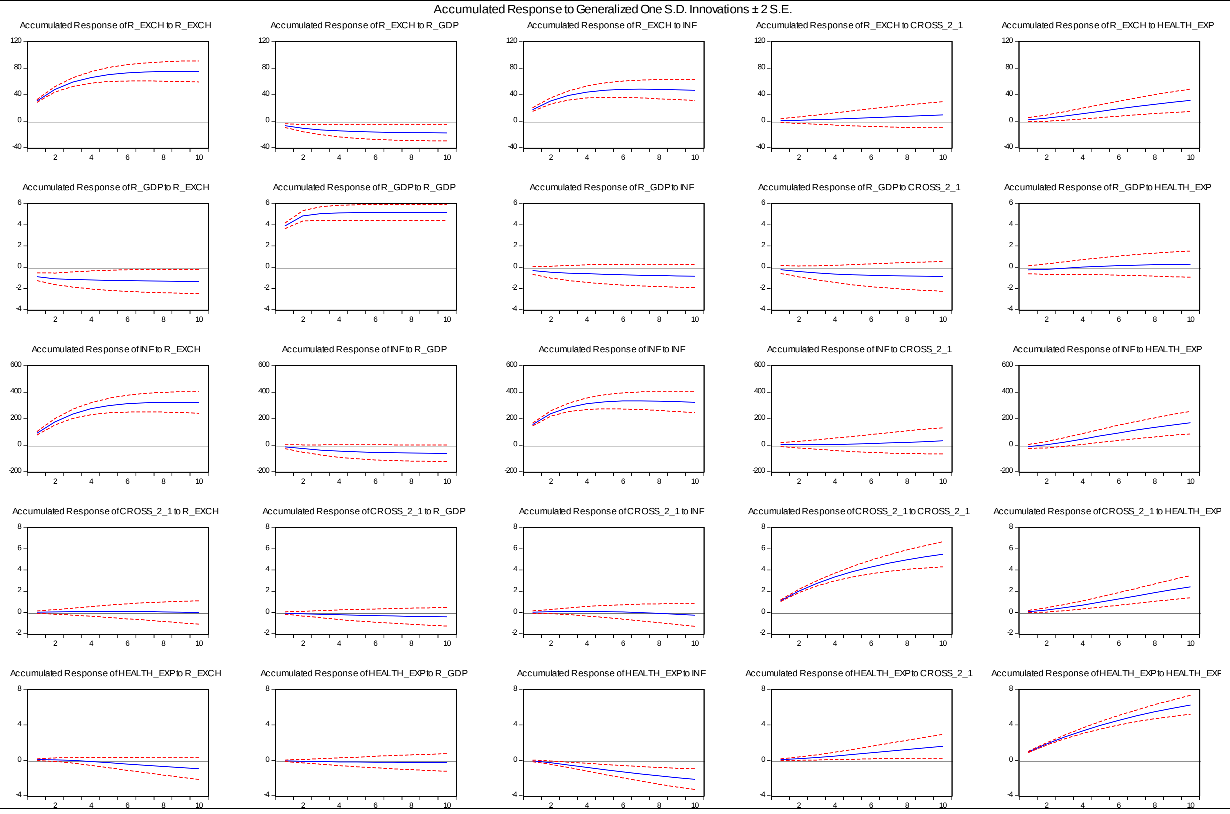
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut0dem1xrreg), EDUCATION_EXP= education expenditure

Appendix D.23. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on military expenditure in Democratic countries



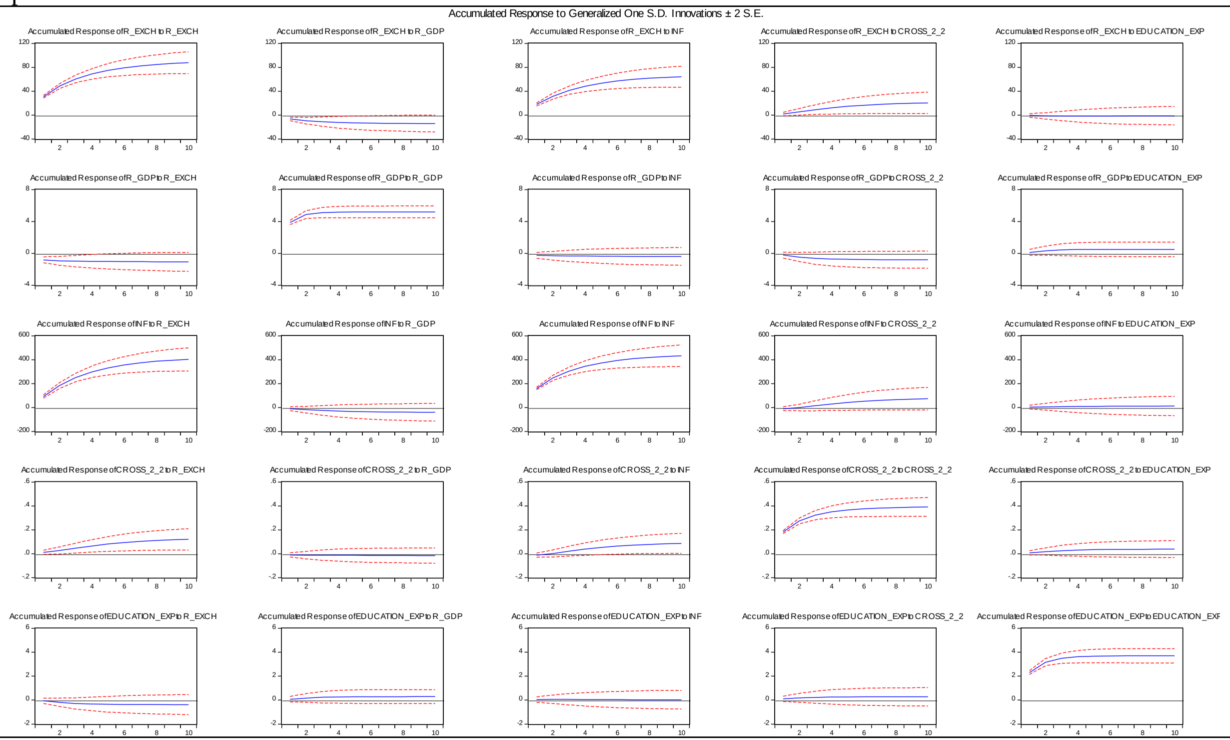
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut0dem1xrreg), MILITARY_EXP= military expenditure

Appendix D.24. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on health expenditure in Democratic countries



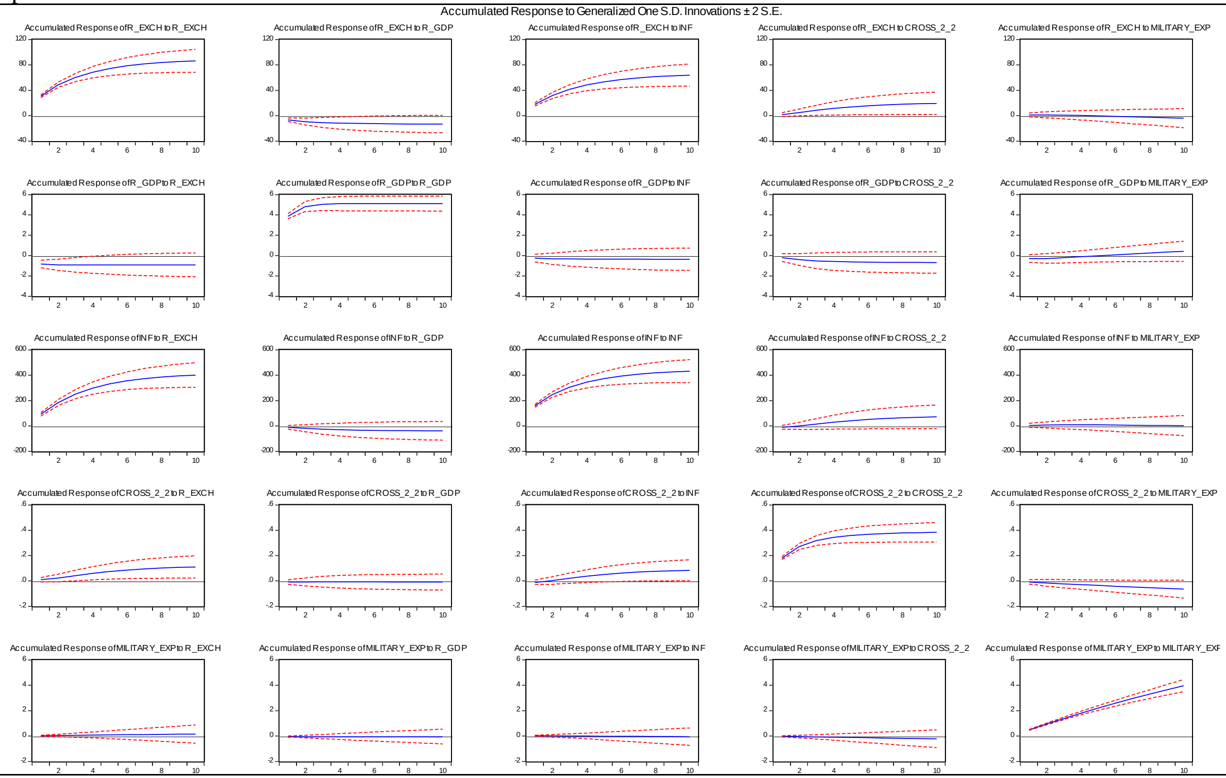
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut0dem1xrreg), HEALTH_EXP= health expenditure

Appendix D.25. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on education expenditure in Democratic countries



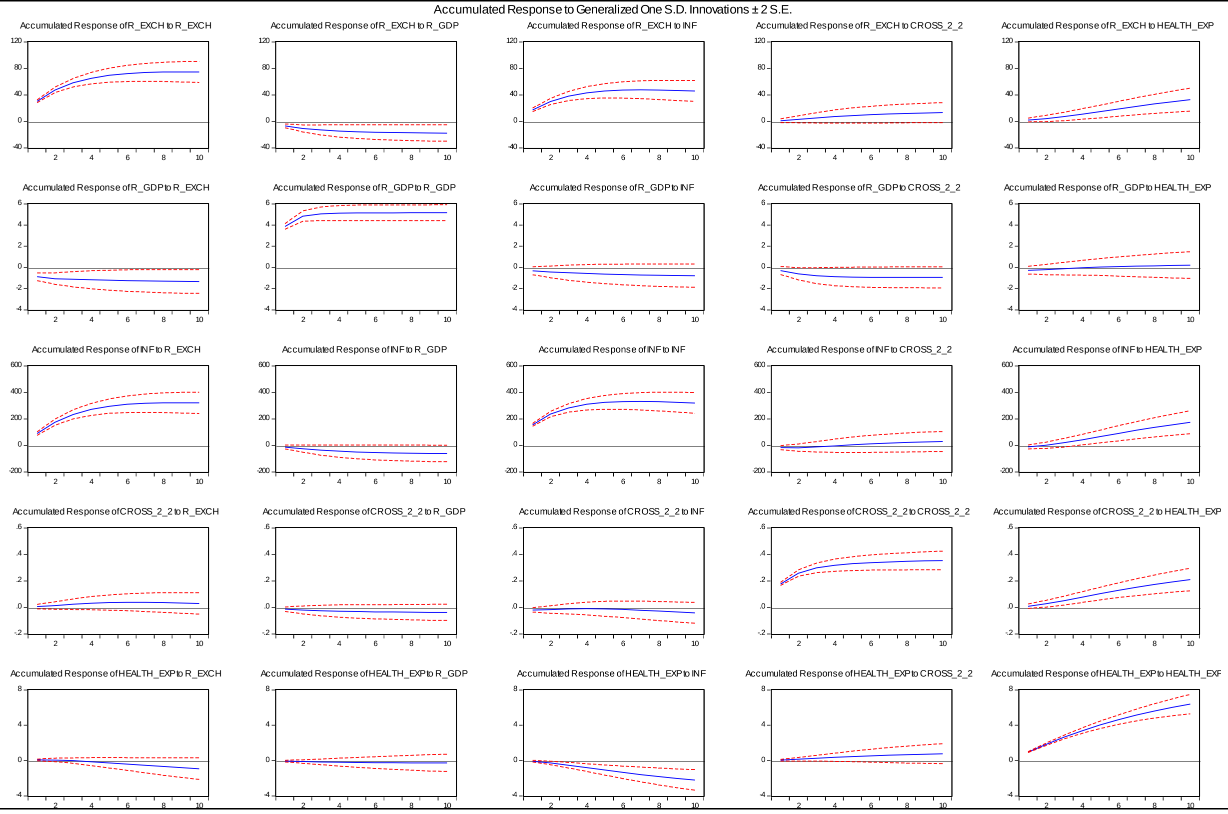
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut0dem1xrreg), EDUCATION_EXP= education expenditure

Appendix D.26. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on military expenditure in Democratic countries



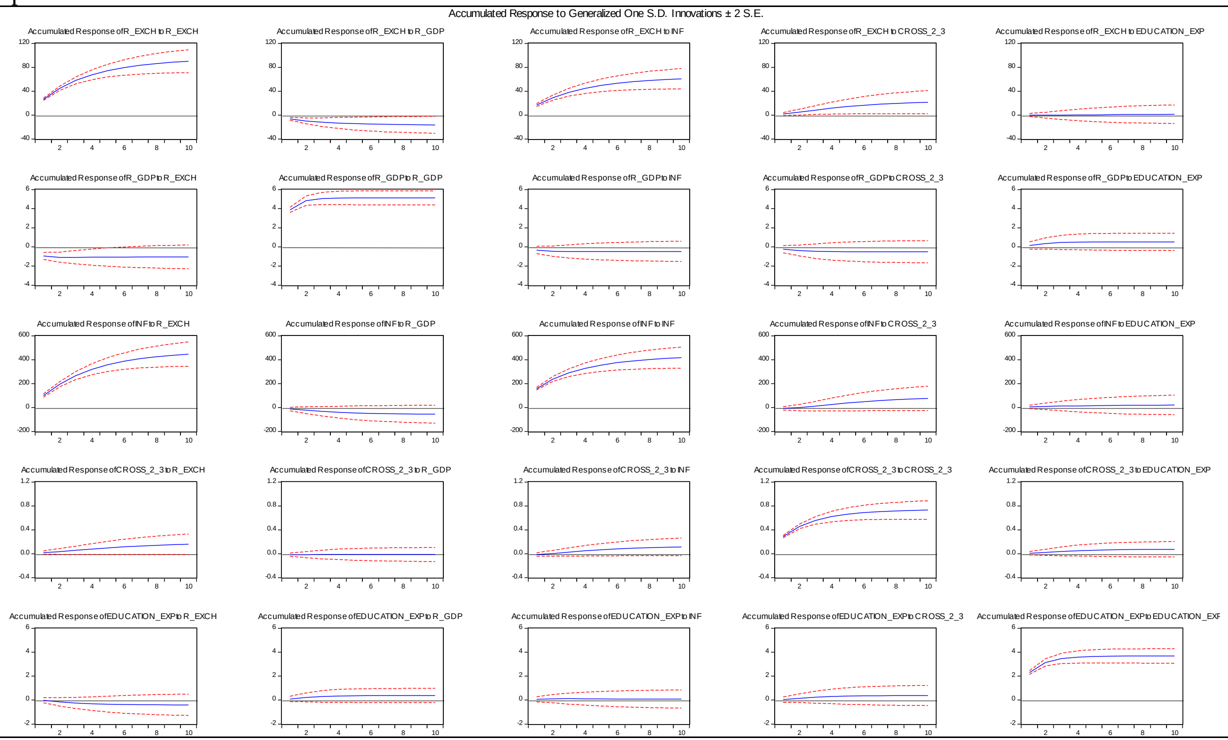
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut0dem1xrreg), MILITARY_EXP= military expenditure

Appendix D.27. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on health expenditure in Democratic countries



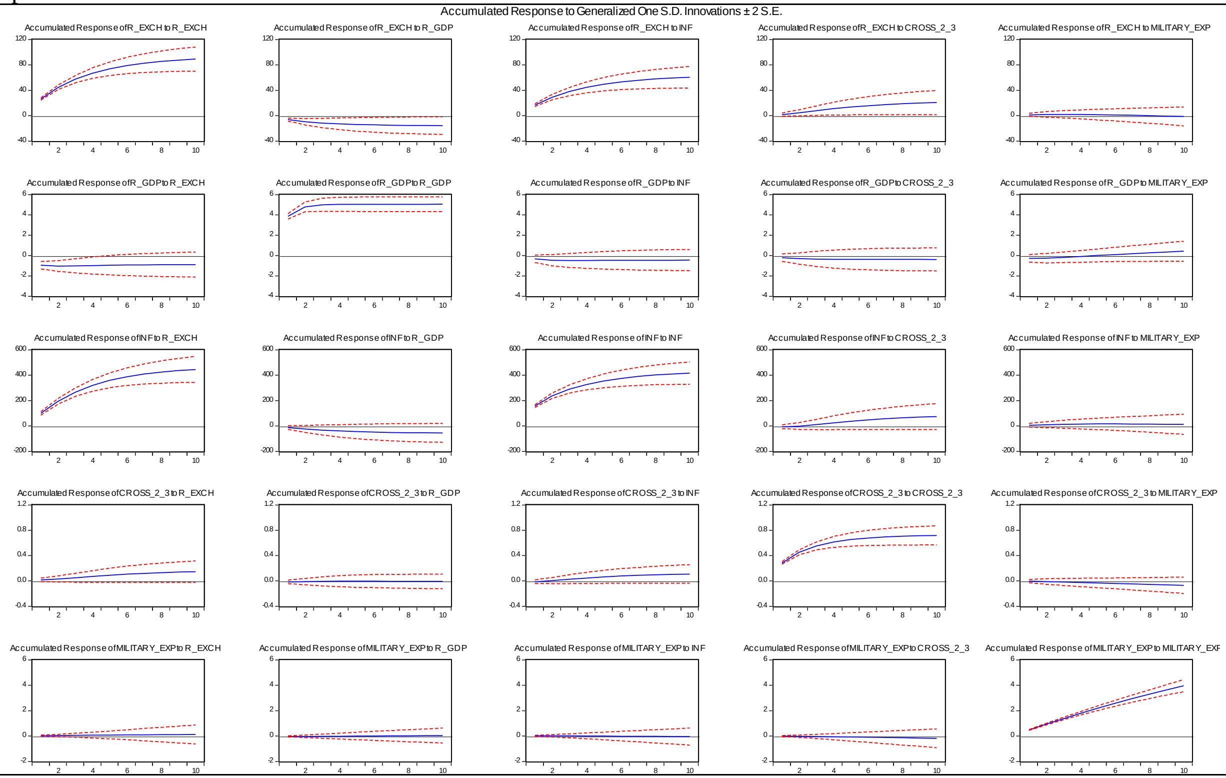
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut0dem1xrreg), HEALTH_EXP= health expenditure

Appendix D.28. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on education expenditure in Democratic countries



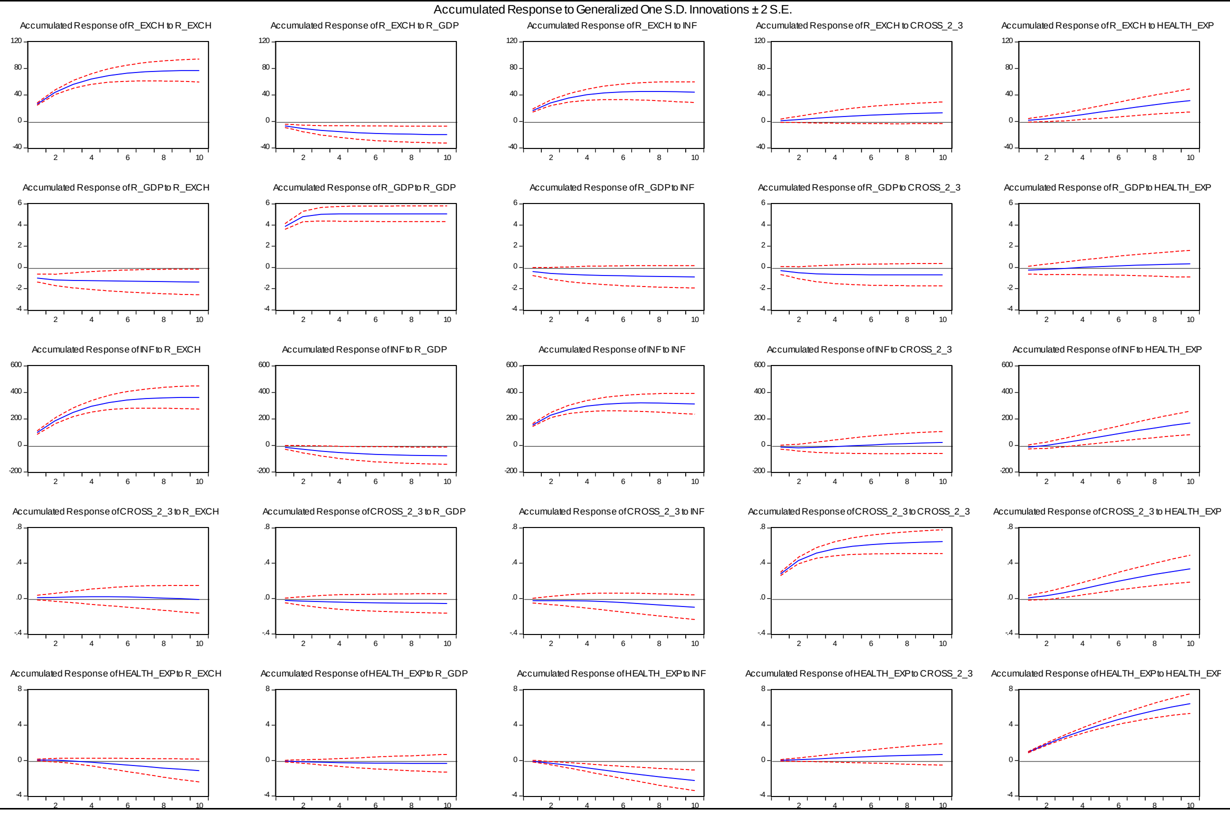
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut0dem1xrreg), EDUCATION_EXP= education expenditure

Appendix D.29. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on military expenditure in Democratic countries



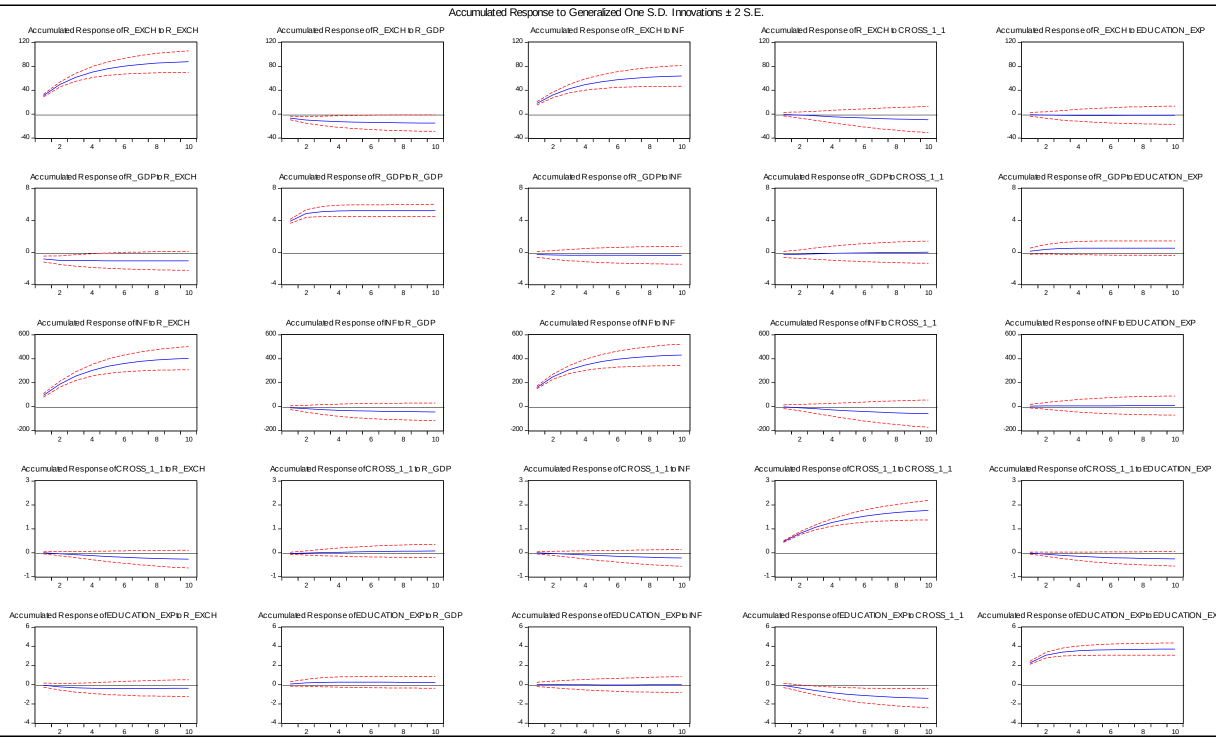
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut0dem1xrreg), MILITARY_EXP= military expenditure

Appendix D.30. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on health expenditure in Democratic countries



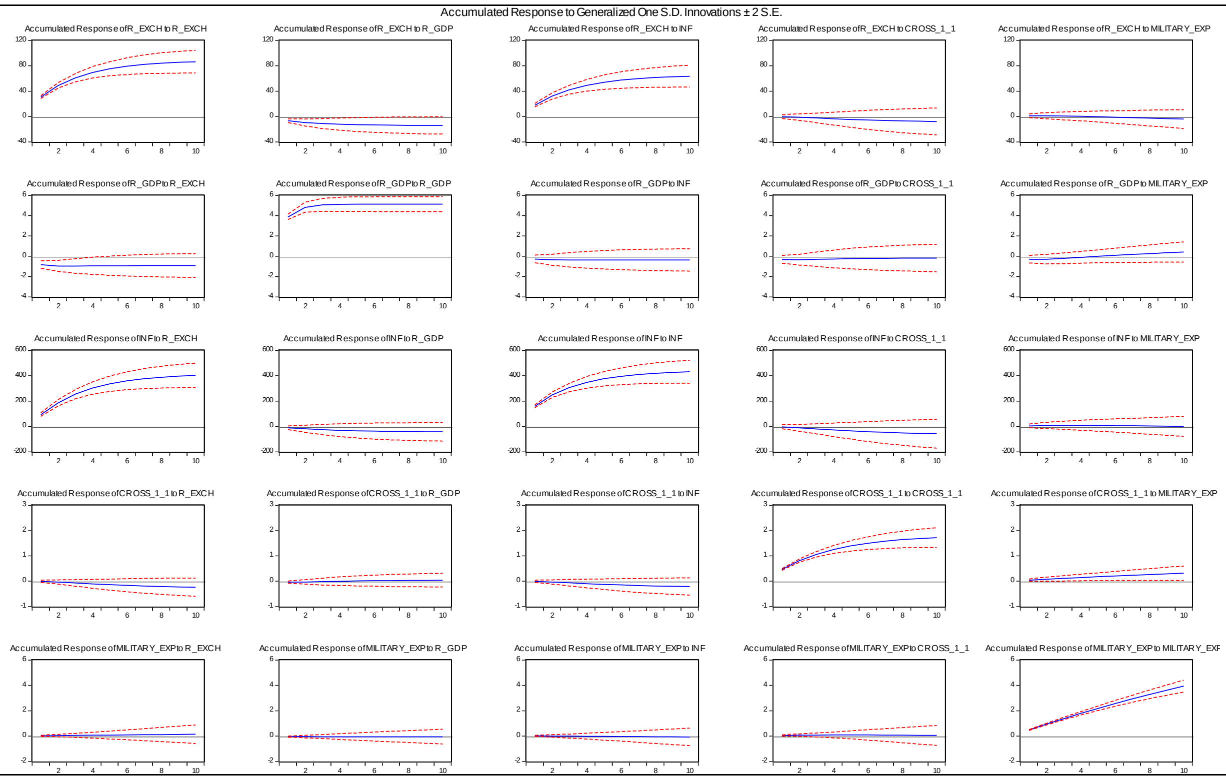
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut0dem1xrreg), HEALTH_EXP= health expenditure

Appendix D.31. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on education expenditure in non-Democratic countries



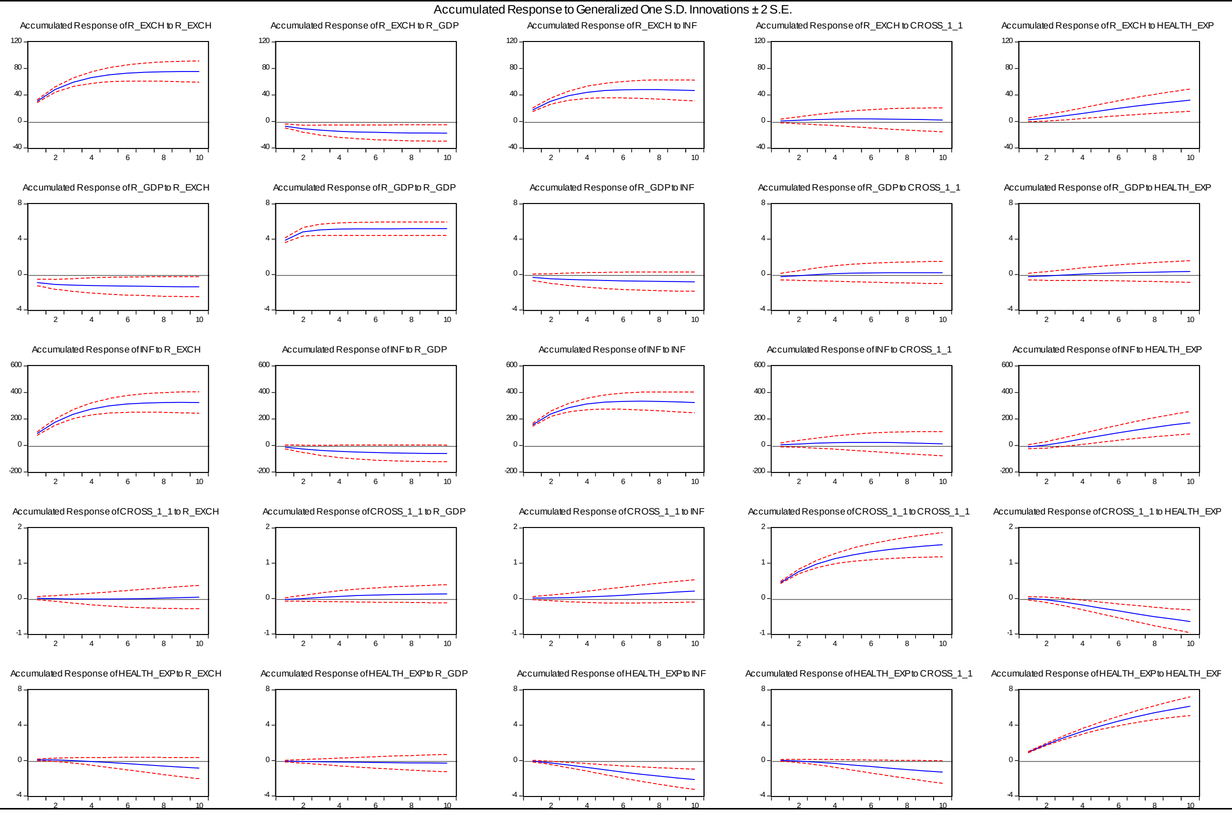
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, EDUCATION_EXP= education expenditure

Appendix D.32. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on military expenditure in non- Democratic countries



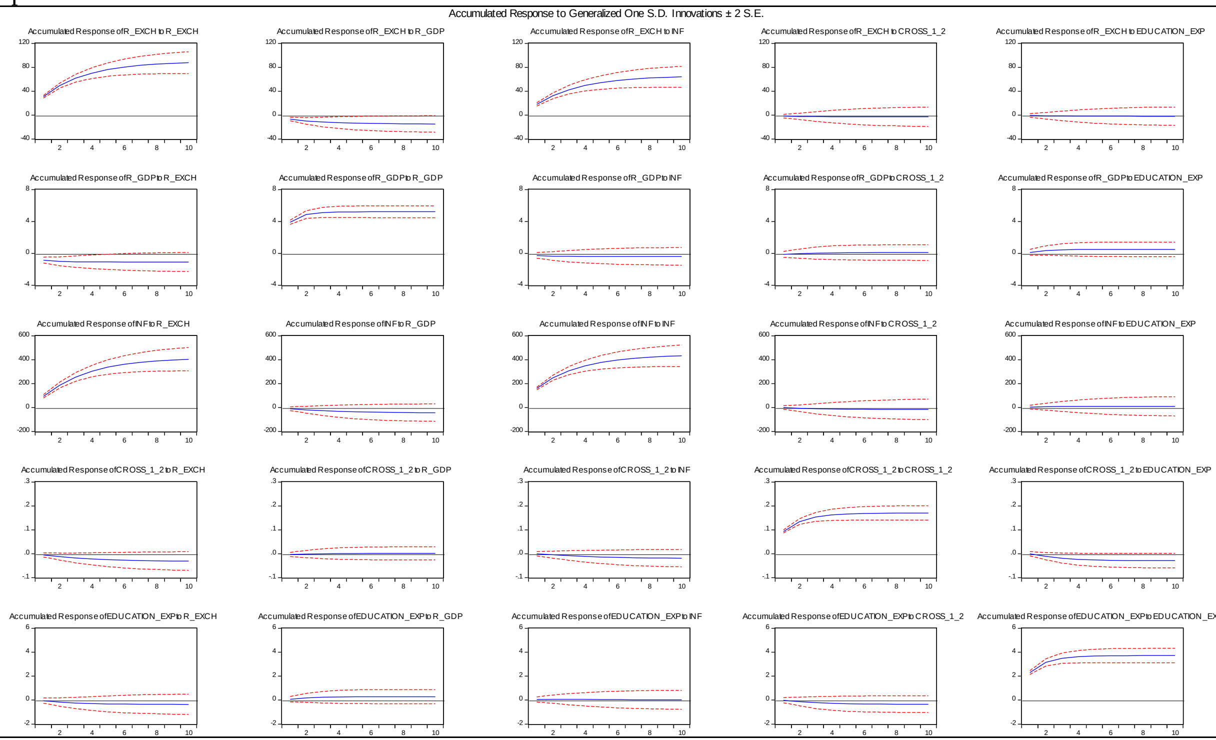
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, MILITARY_EXP= military expenditure

Appendix D.33. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on health expenditure in non-Democratic countries



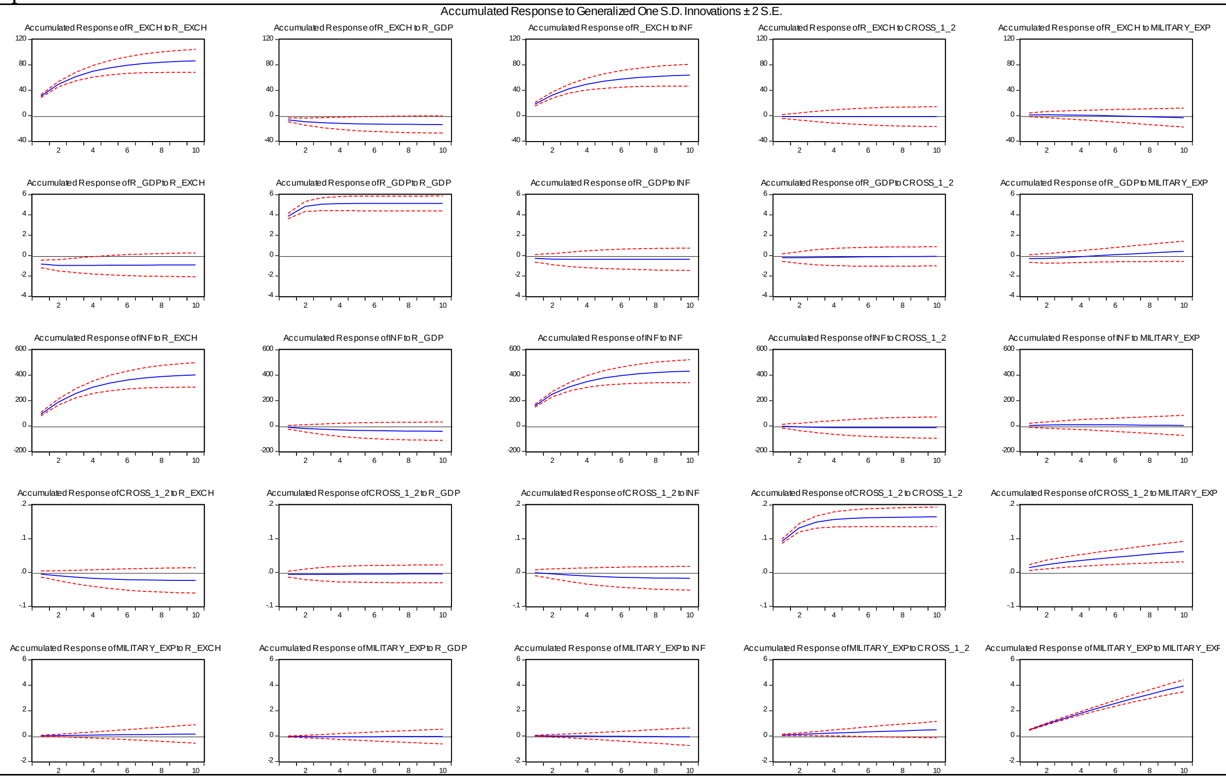
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_1= OilV_aut1dem0, HEALTH_EXP= health expenditure

Appendix D.34. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on education expenditure in Non-Democratic countries



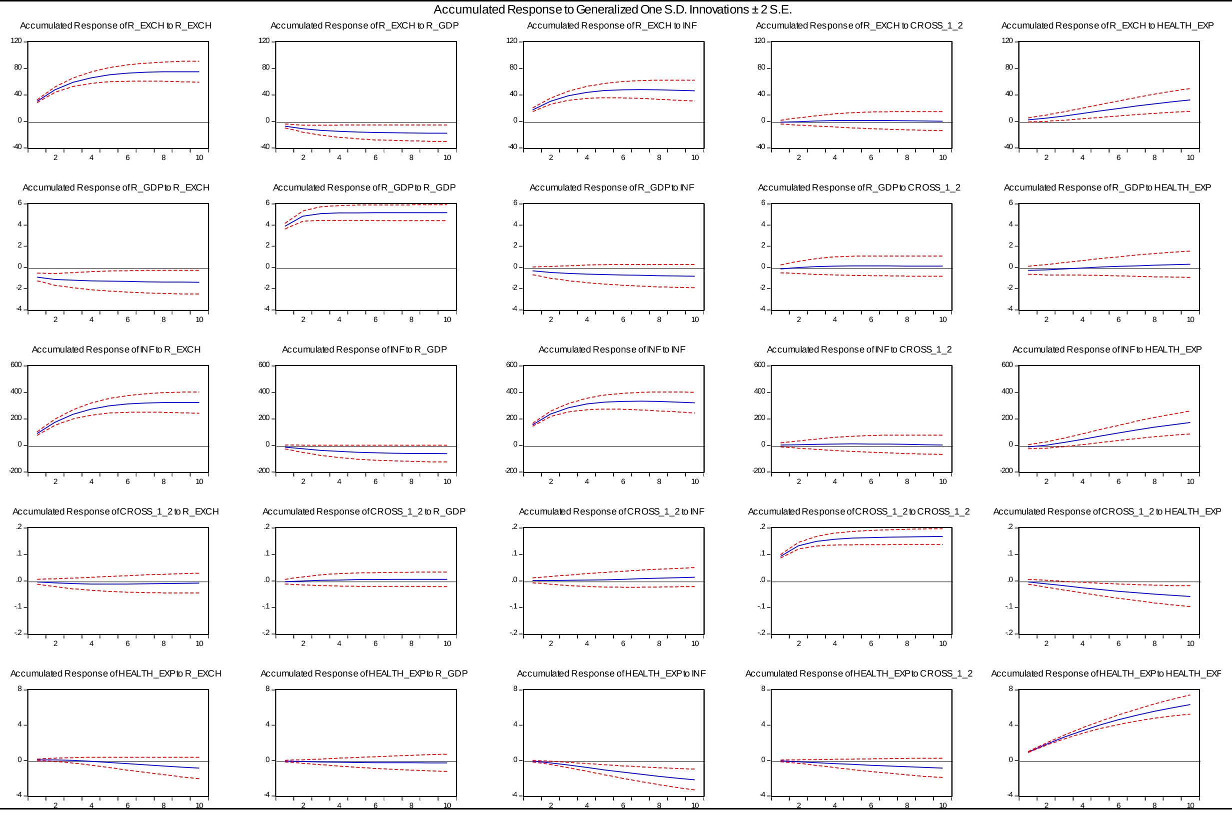
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, EDUCATION_EXP= education expenditure

Appendix D.35. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on military expenditure in Non-Democratic countries



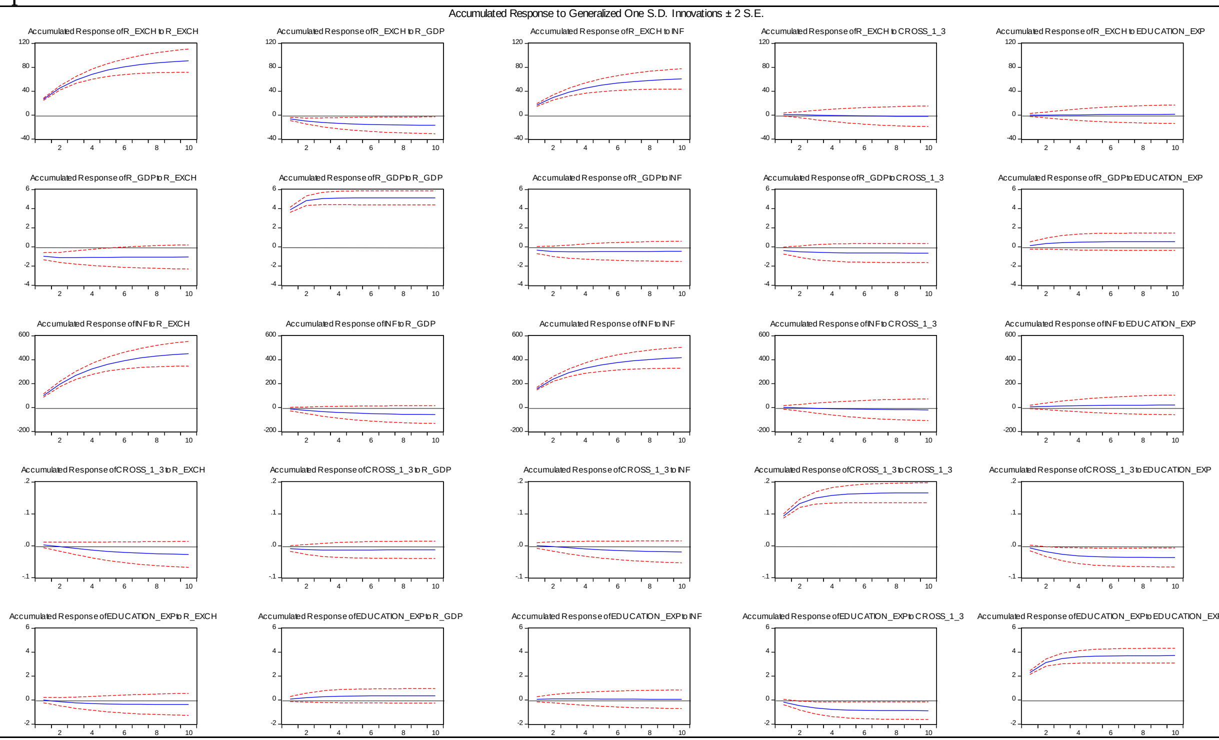
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, MILITARY_EXP= military expenditure

Appendix D.36. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on health expenditure in Non-Democratic countries



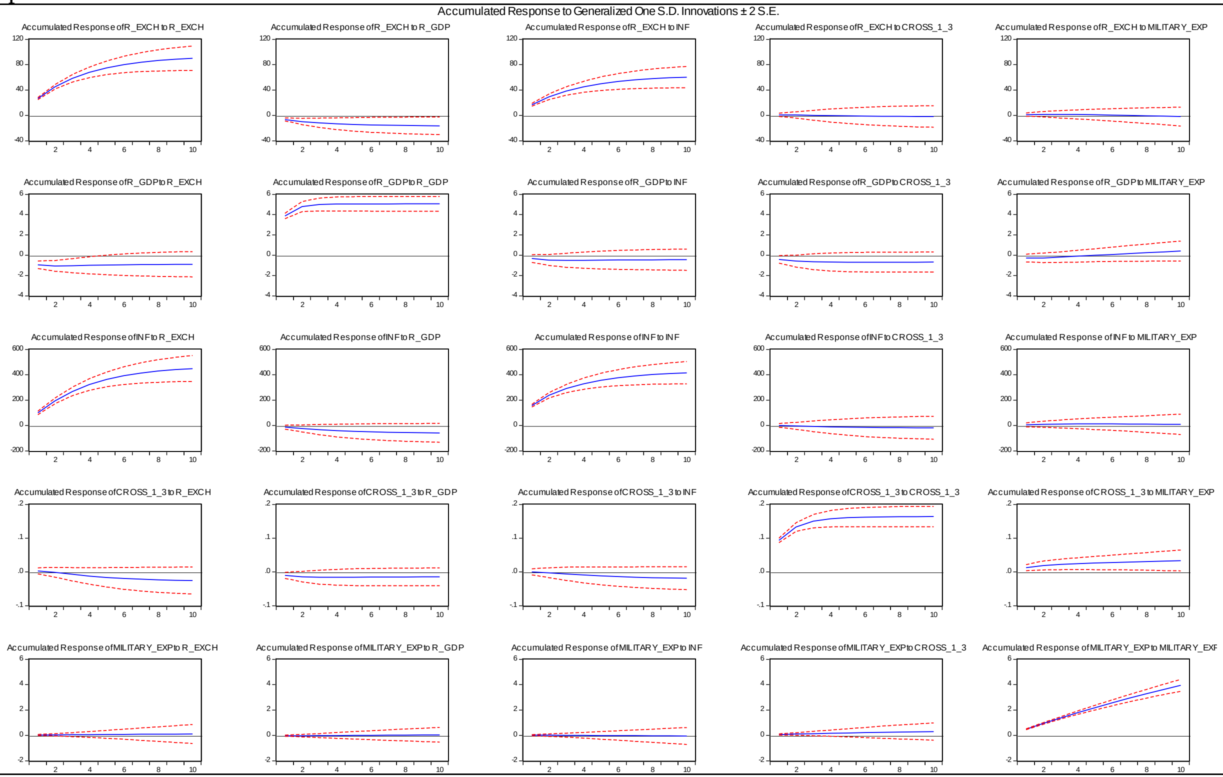
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_2= OilrevenueV_aut1dem0, HEALTH_EXP= health expenditure

Appendix D.37. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on education expenditure in Non-Democratic countries



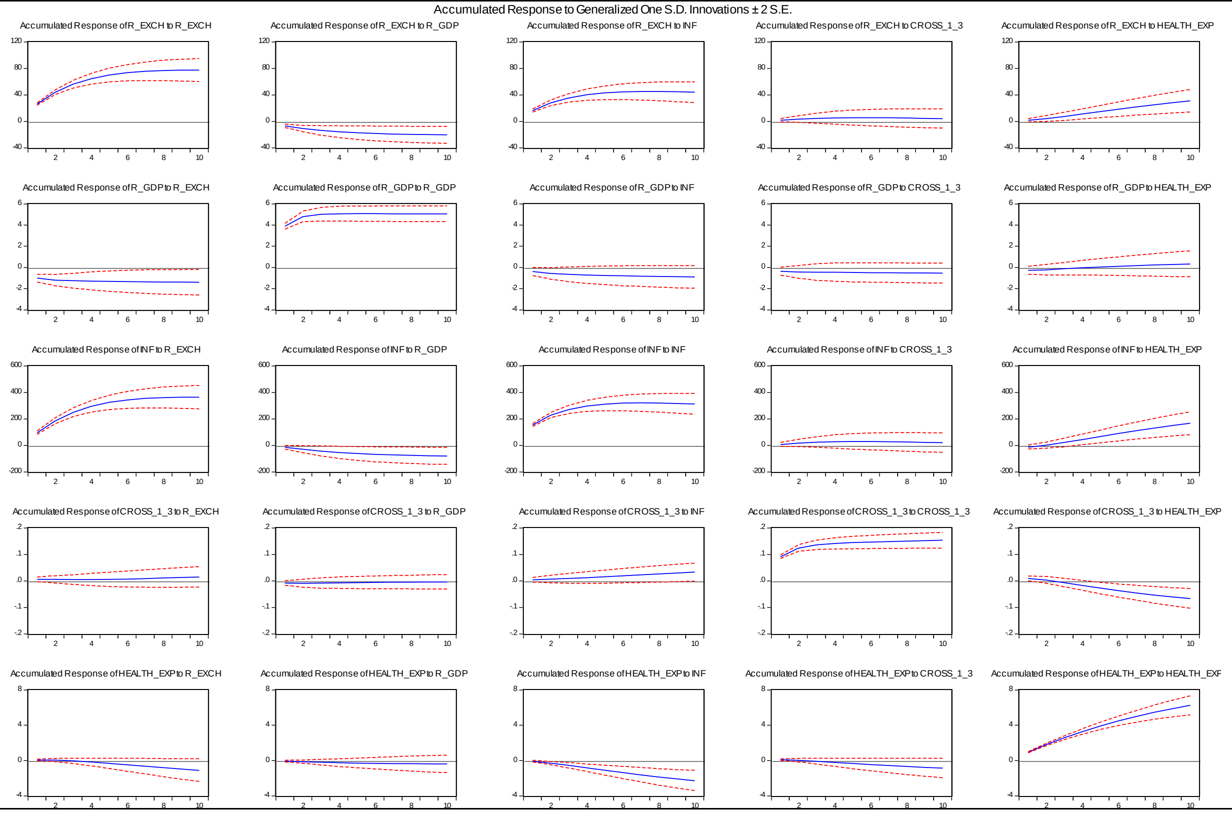
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= (OilrentV_aut1dem0), EDUCATION_EXP= education expenditure

Appendix D.38. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on military expenditure in non-Democratic countries



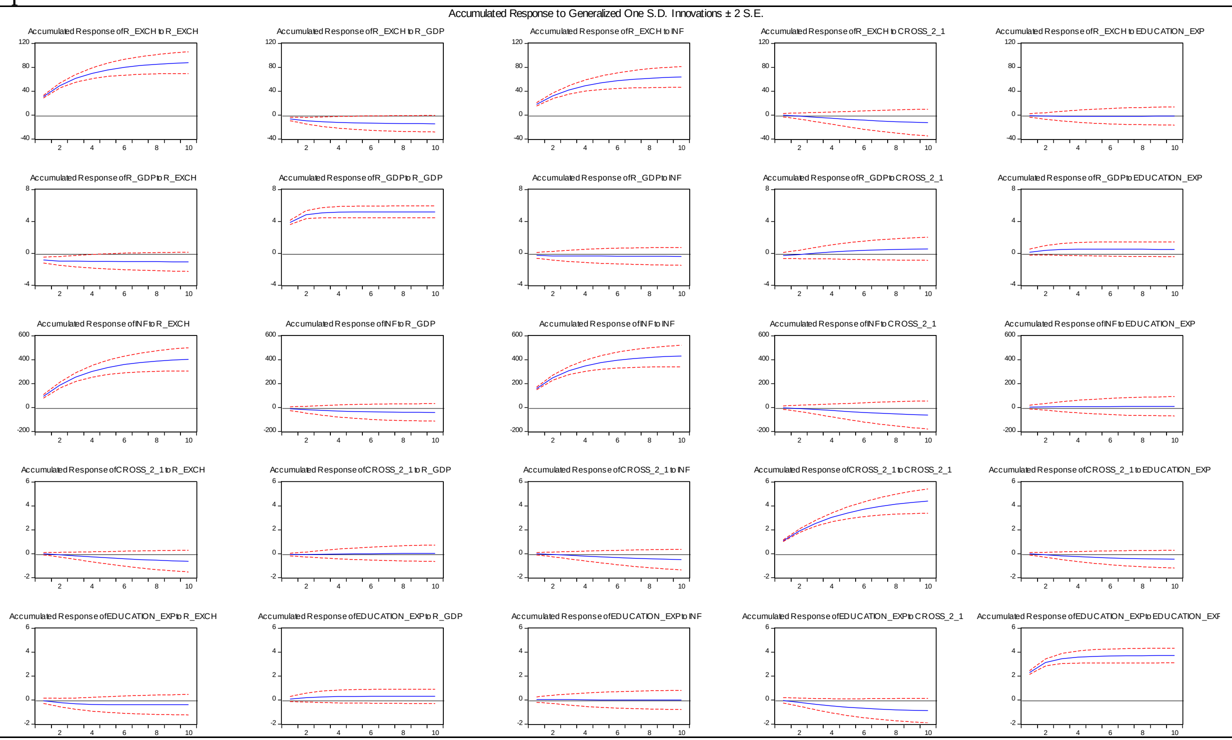
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= (OilrentV_aut1dem0), MILITARY_EXP= military expenditure

Appendix D.39. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on health expenditure in Non-Democratic countries



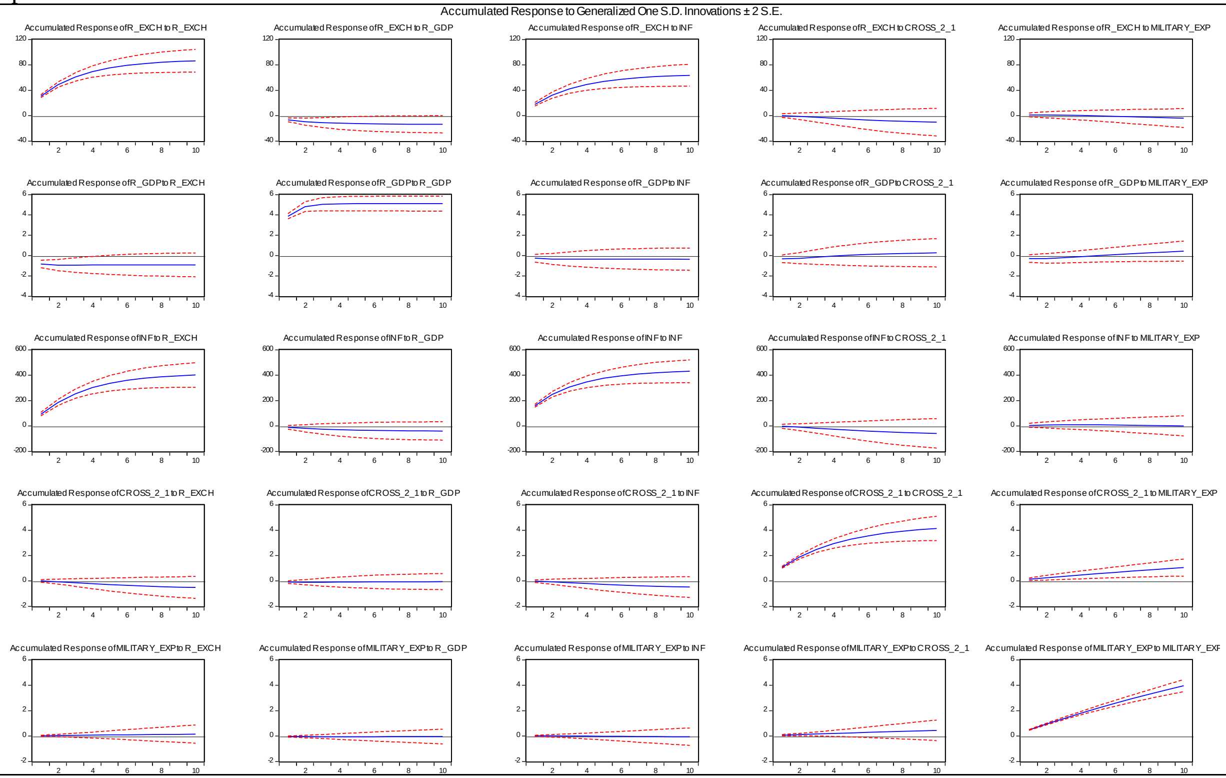
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_1_3= (OilrentV_aut1dem0), HEALTH_EXP= health expenditure

Appendix D.40. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on education expenditure in Non-Democratic countries



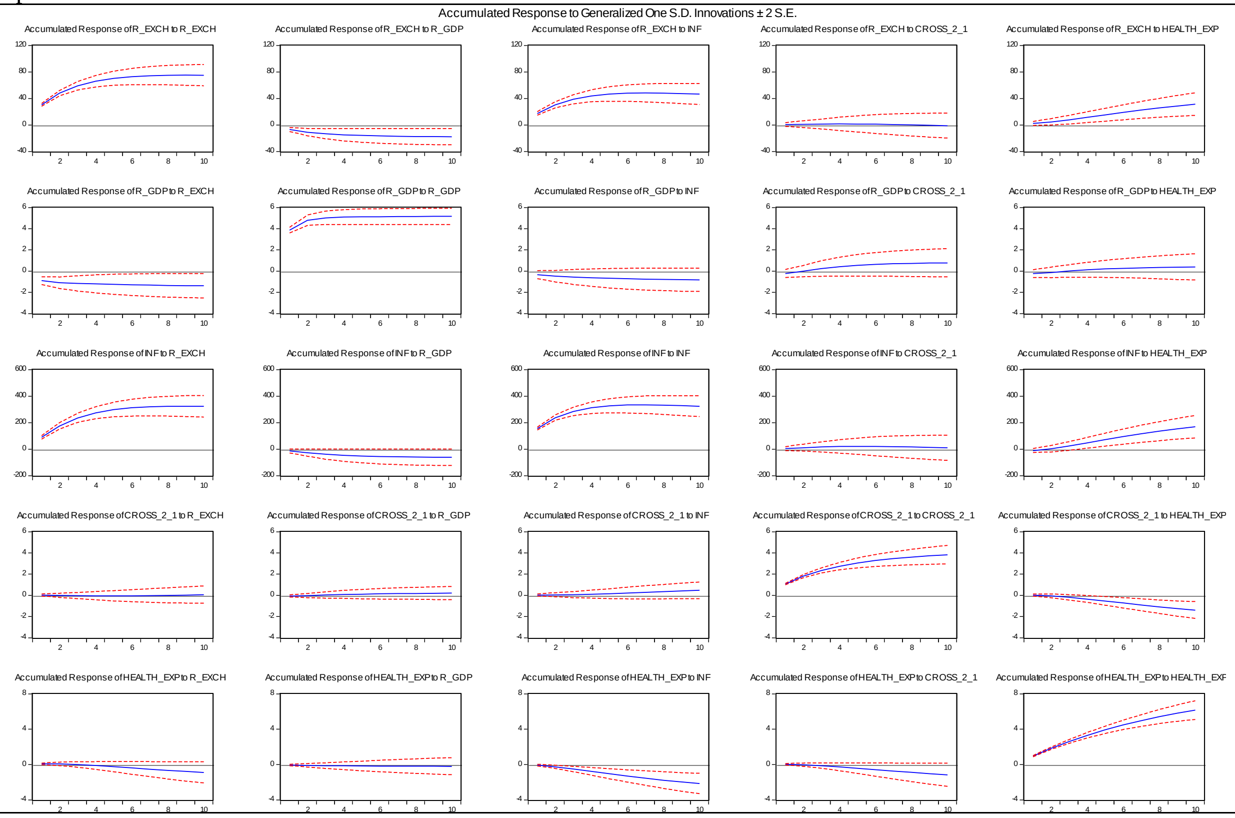
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut1dem0xrreg), EDUCATION_EXP= education expenditure

Appendix D.41. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on education expenditure in Non-Democratic countries



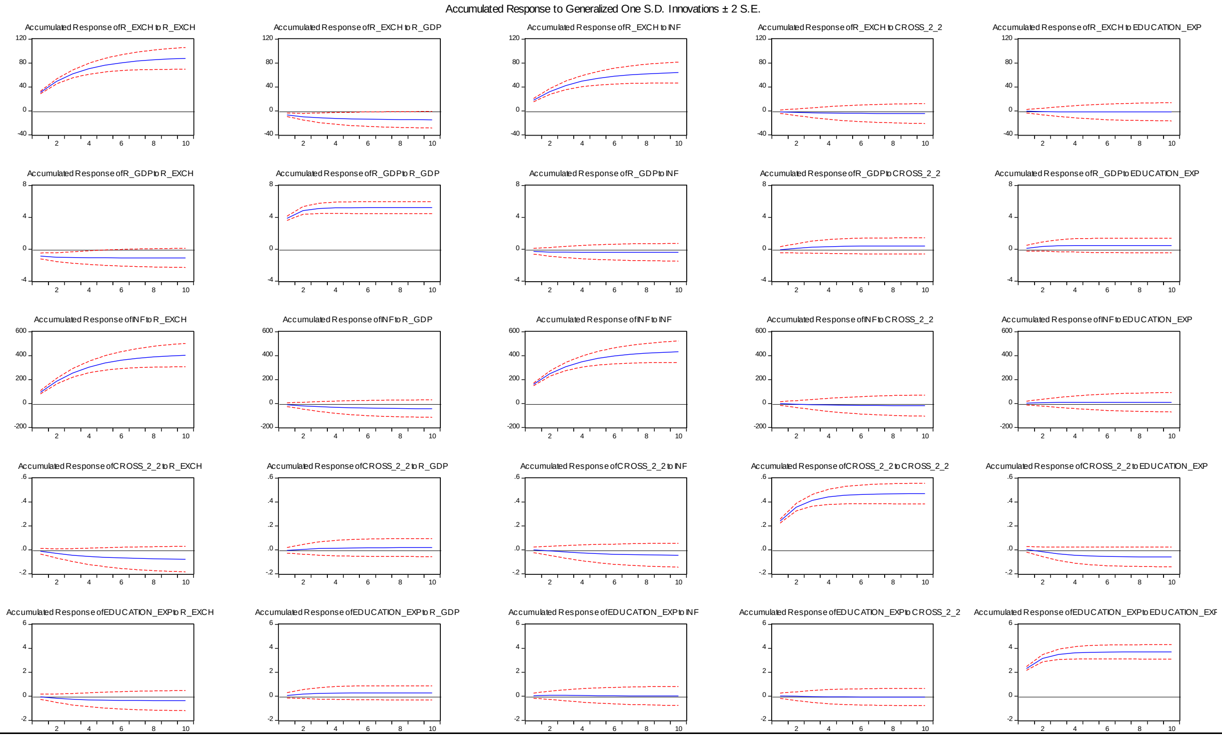
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut1dem0xrreg), MILITARY_EXP= military expenditure

Appendix D.42. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg) on education expenditure in Non-Democratic countries



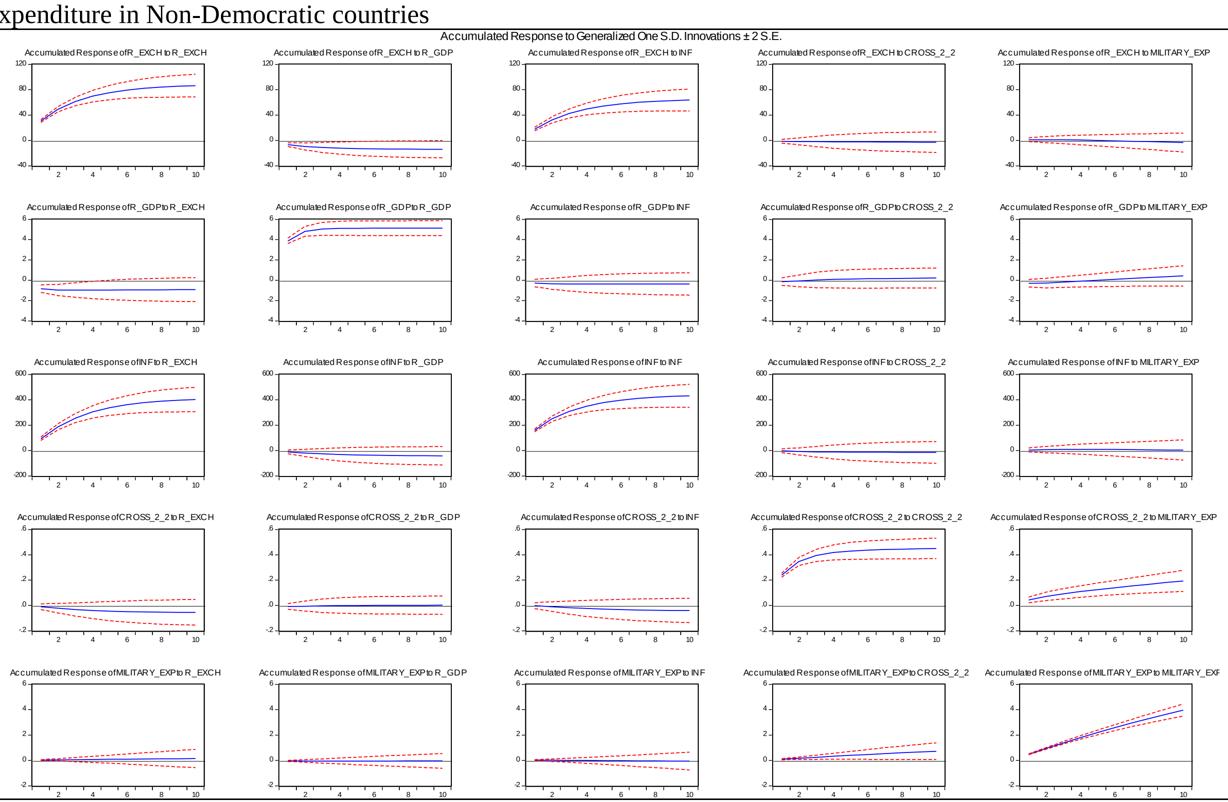
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_1= (OilV_aut1dem0xrreg), HEALTH_EXP= health expenditure

Appendix D.43. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on education expenditure in Non-Democratic countries



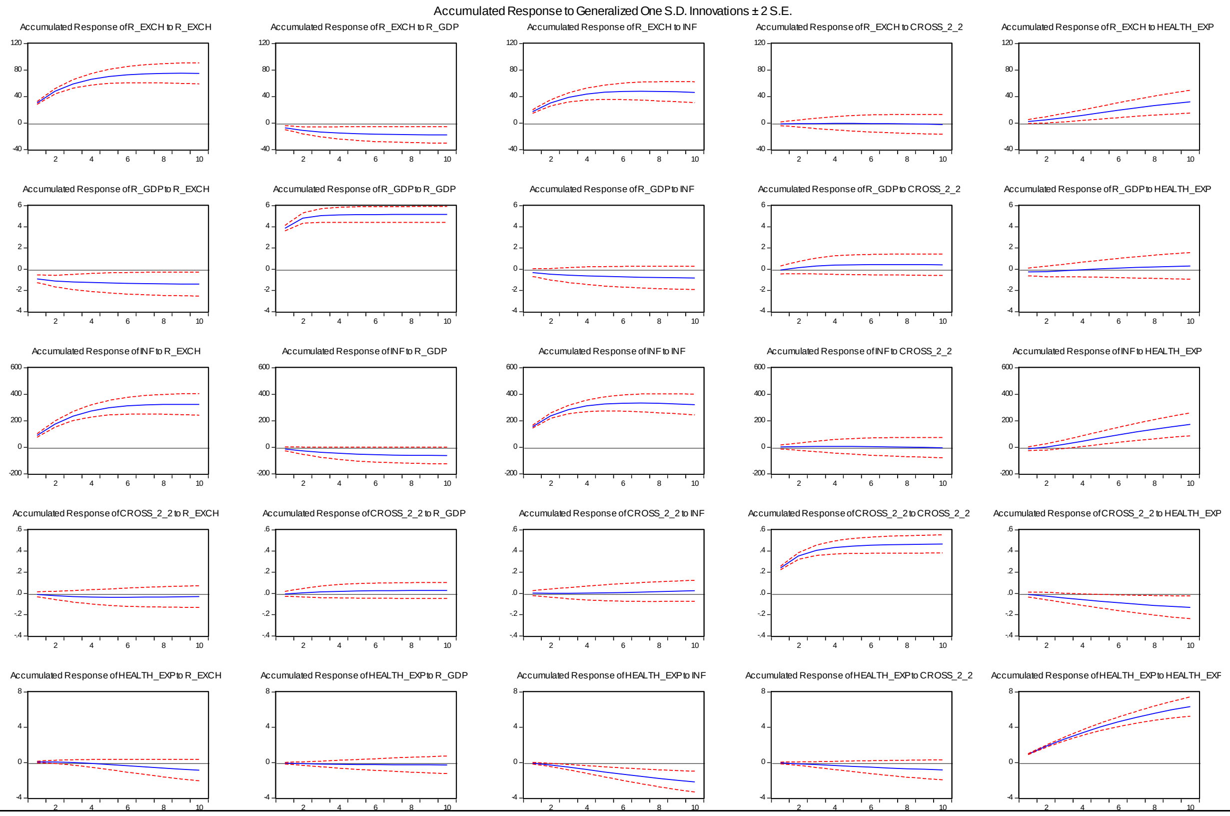
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut1dem0xrreg), EDUCATION_EXP= education expenditure

Appendix D.44. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on military expenditure in Non-Democratic countries



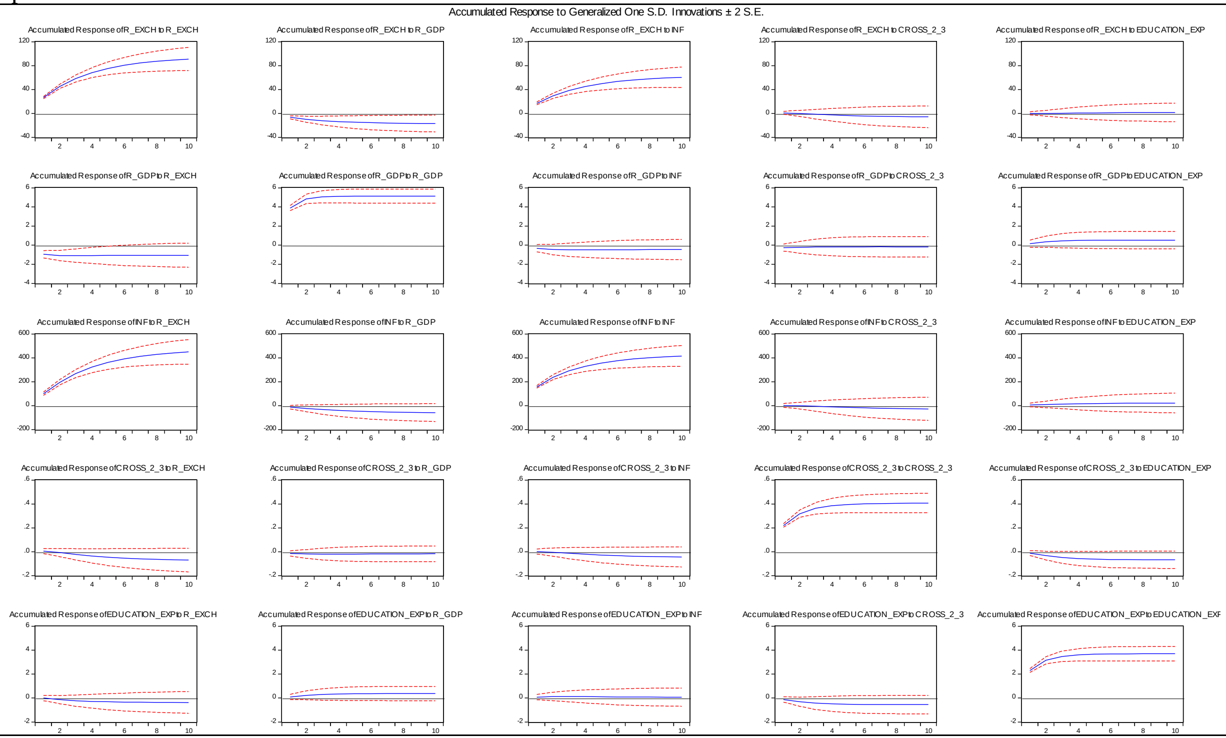
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut1dem0xrreg), MILITARY_EXP= military expenditure

Appendix D.45. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg) on health expenditure in Non-Democratic countries



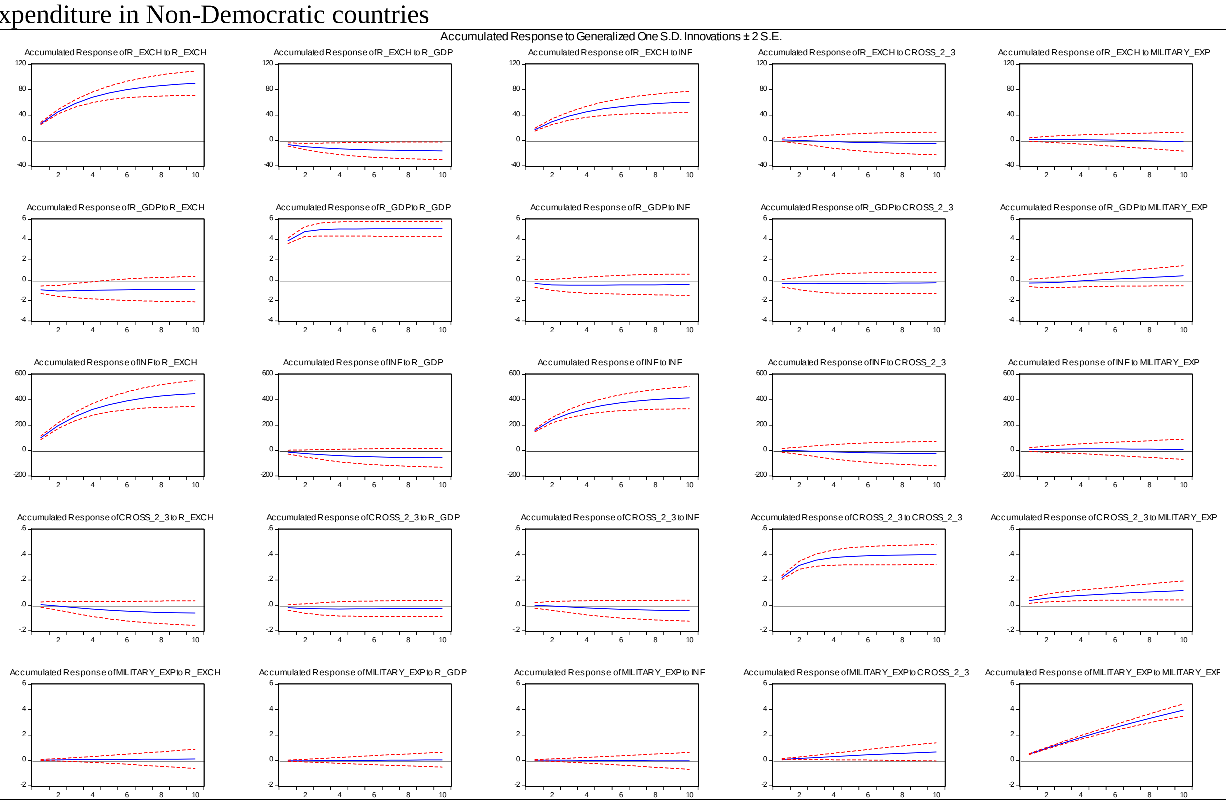
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_2= (OilrevenueV_aut1dem0xrreg), HEALTH_EXP= health expenditure

Appendix D.46. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on education expenditure in Non-Democratic countries



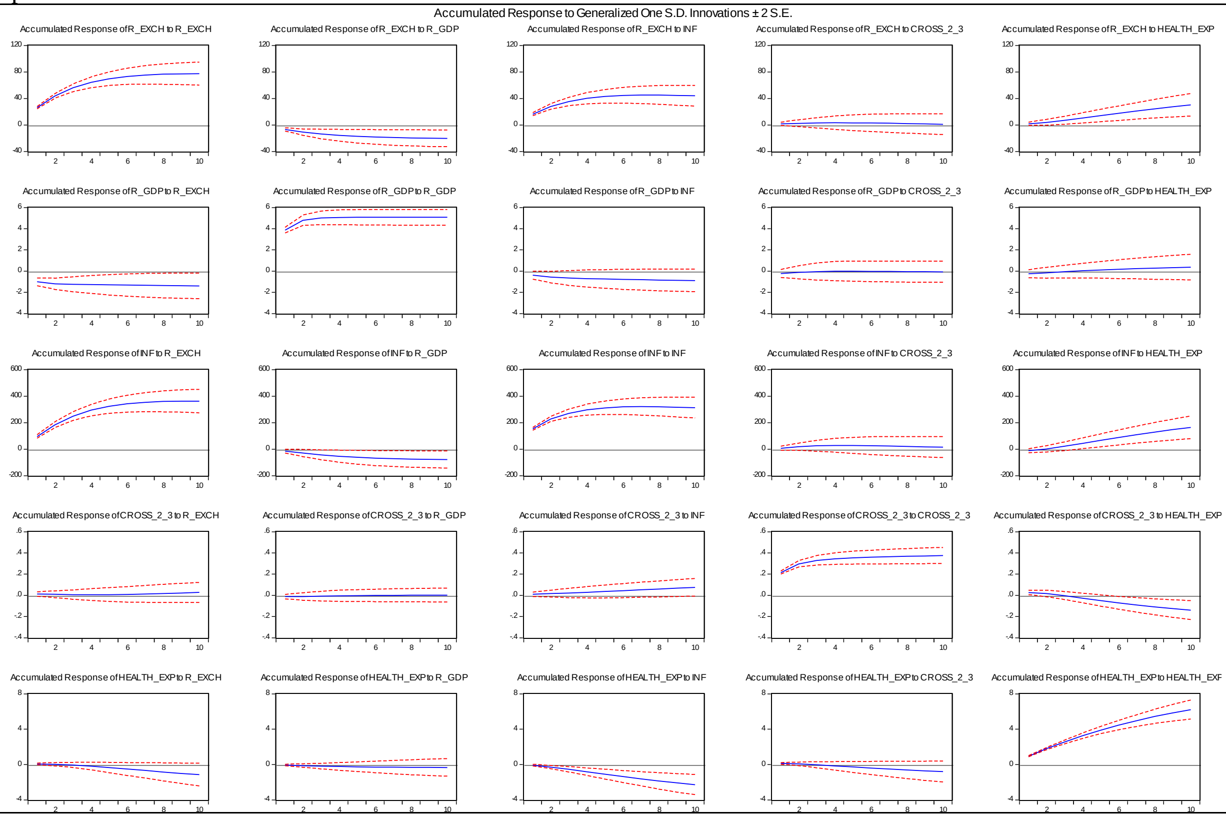
Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut1dem0xrreg), EDUCATION_EXP= education expenditure

Appendix D.47. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on military expenditure in Non-Democratic countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut1dem0xrreg), MILITARY_EXP= military expenditure

Appendix D.48. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg) on health expenditure in Non-Democratic countries



Note: R_EXCH= exchange rate, R_GDP= GDP per capita, INF= inflation rate, CROSS_2_3= (OilrentV_aut1dem0xrreg), HEALTH_EXP= health expenditure

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