The dynamic impact among oil dependence volatility, the quality of political institutions, and government spending

Azadeh Pazouki [a,b,*], Xiaoxian Zhu [b]

[a] *University of Bedfordshire Business School, University of Bedfordshire, Luton, LU1 3JU, UK*
[b] *Teesside University Business School, Teesside University, Middlesbrough TS1 3BA, UK*

ABSTRACT

This paper empirically examines the direct and indirect effect of the role of democracy, and, in turn, the effect of oil dependence volatility on governmental expenditure in oil exporting countries. To achieve this aim, we apply a panel Vector Auto-Regressive (PVAR) model along with panel impulse response functions from the period 1983 to 2016. The findings show that 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 respond to oil volatility fluctuating between the positive and negative depending 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. Therefore, an improvement in strategic risk planning together with greater government transparency could lead to institutional quality improvement.

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 (Copaken, 1995). 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. Supply and demand influence price which therefore becomes the key factor in the decision-making process (Hamilton, 2009a, 2009b; Matar et al., 2013). To that end, oil price forecasting is a critical tool of 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 which have the capacity to destabilise the market and create volatility, and increase both risk and uncertainty (Basak and Pavlova, 2016; Ma et al., 2019).

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 influence of oil price volatility on the economy is not a simple task as it establishes a tangible 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 part 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

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any fluctuation in oil prices and associated increase/decrease in oil price volatility.

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). According to Andersen and Ross (2014), there has been a severe resource curse since the 1970s as a result of "oil wealth only became a hindrance to democratic transitions after the transformative events of the 1970s, which enabled developing country governments to capture the oil rents that were previously siphoned off by foreign-owned firms" (Andersen and Ross, 2014, p. 993). Moreover, there is a link between changes in oil revenue and changes in democracy. In other words, countries with other characteristics held constant are more likely to become less democratic as it becomes richer in oil (Aslaksen, 2010).

The constituent elements of institutions in an oil economy undoubtedly affects the distribution and expenditure of oil revenues. The aim of this study is to empirically examine the direct and indirect effect of the role of democracy, and, in turn, the effect of oil dependence 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 2016.

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. In this way, this study analyses the effects of oil dependence volatility on government spending, as a percentage of GDP, and does this in this study by separating the countries into two groups, one democratic and the other non-democratic.

The remainder of the paper is organized as follows. Section 2 reviews the related literature, Section 3 describes the methodology and data used in the study, and Section 4 presents the empirical findings. Finally, Section 5 concludes the study adding the main implications for policy making and ideas for further research.

2. Literature review

2.1. Oil dependence volatility and the government spending

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.

There are only few studies that concentrate on the effects of oil dependence volatility on the government in oil-exporting countries (Rutten, 2001; Chemingui and Hajeeh, 2011; Oriakhi and Osaze, 2013; Alley, 2016).

Chemingui and Hajeeh (2011) extend the research to study the impact of oil price volatility on domestic tax and subsidy policies in the Kuwaiti economy. The empirical findings show that for a set of scenarios aimed at raising government savings through tax increases or subsidy cuts, the least negative effect on household welfare is when the work studies and subsidies 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). 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. In addition, 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.

Both short-run and long-run impacts of oil price volatility on the fiscal policy of 18 oil-exporting countries have been analysed by Alley (2016). The results demonstrate that oil price volatility decreased by a primary fiscal balance in the short run but increase in the long-run, suggesting that governments eventually consolidate their fiscal positions to reduce short-run fiscal deficit induced by oil price volatility. However, their fiscal policies were pressured in the short-run, they were able to stabilize their fiscal dynamics in the long-run.

2.2. Oil dependence volatility and quality of economic institutions (democratic and non-democratic countries)

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), for example, 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 neutralised. El-Anshasy et al. (2015) examine a study of 17 important oil countries and find that better institutions (financial policy) can neutralise the negative impacts 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.

2.3. Theoretical background

The 'resource curse' hypothesis indicates that countries with an abundance of natural resources (e.g.,petroleum) tend to have less economic growth, less democracy and lower institutional quality than countries with fewer natural resources (Mollick et al., 2020; Gilberthorpe and Papyrakis, 2015; Boutilier, 2017; Manzano and Gutiérrez, 2019; Ross, 2019; Moisé, 2020).

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
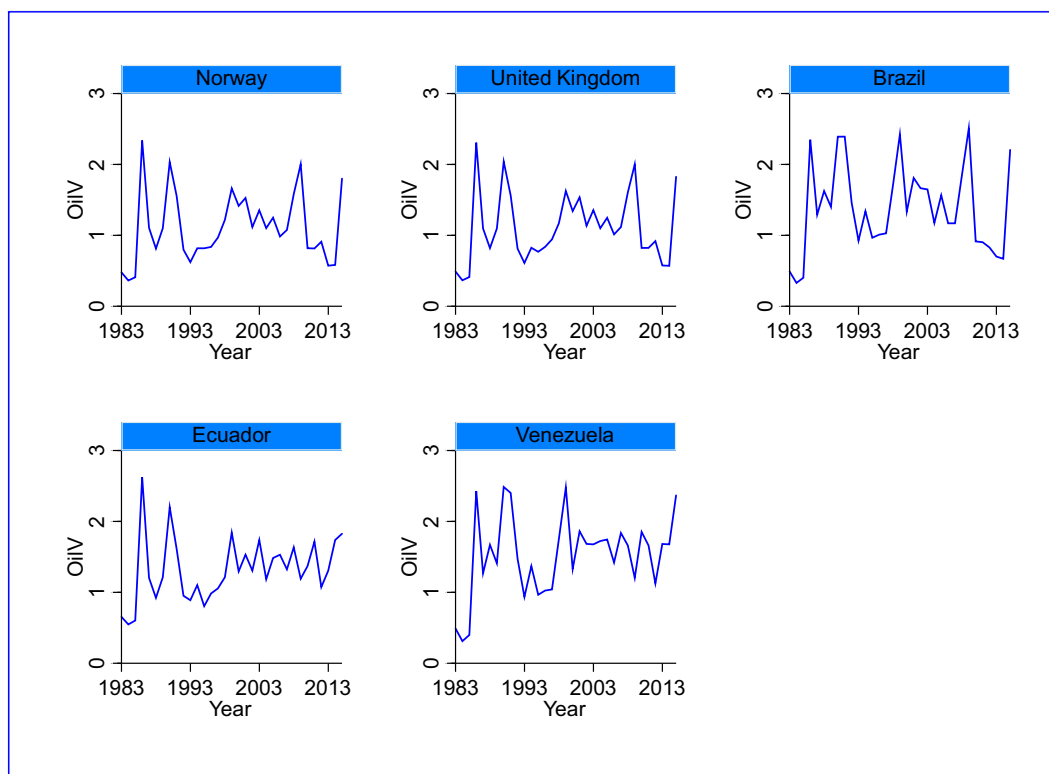
Fig. 1. Oil price volatility for five oil exporting democratic countries.

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 (Mollick et al., 2020; Aslaksen, 2010).

2.4. Quality of economic institutions and government spending

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 (1998) 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.

2.5. Political debate and research gap

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. 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. Thus, it is significant 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.

3. Data

This paper is extracted data from the Datastream, World Bank, US Energy Information Administration (EIA), Polity IV project. The period of study runs from 1983 to 2016 and the frequency of our series is annual.

Therefore, we collect the following data:

3.1. Oil volatility proxies

In this study we use three proxies for oil market volatility, namely, oil price volatility, oil revenue volatility and oil rents volatility. To construct annualised oil price volatility, we use monthly data of the Brent crude oil prices over the period from January 1983 through to December 2016. Brent prices have been collected in US dollars but then transformed into local currency at a monthly frequency for oil-exporting countries. To measure oil revenue, we multiply oil exports of each
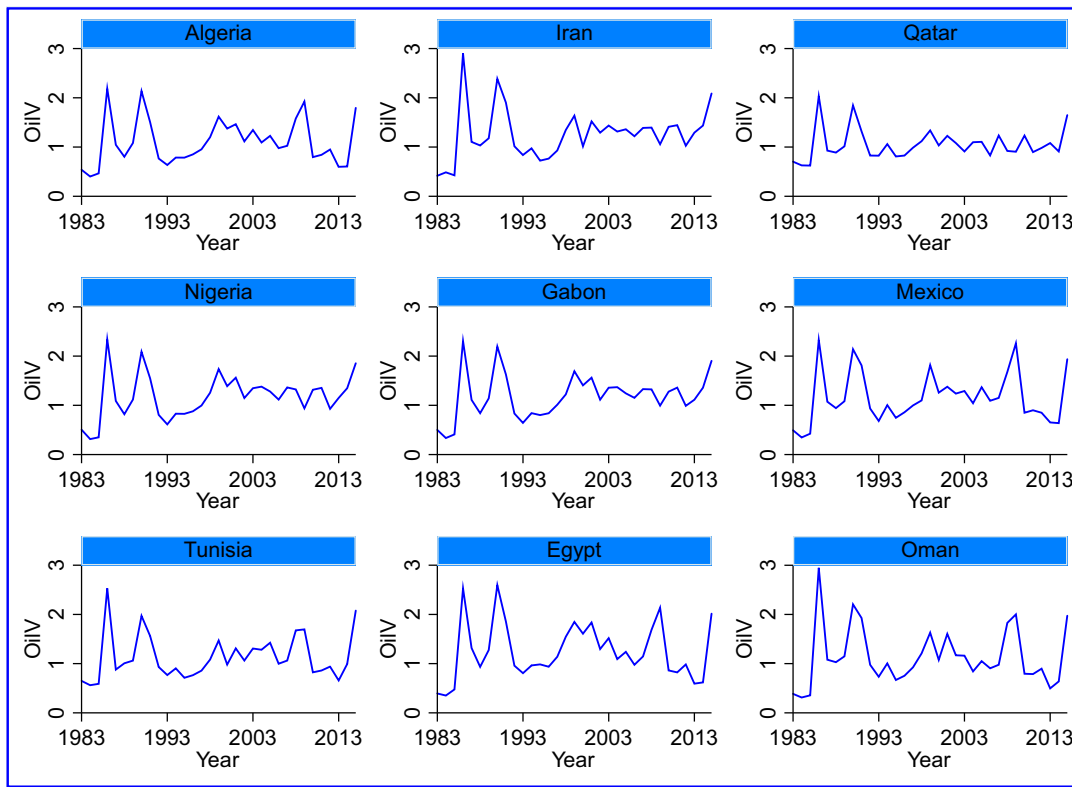
Fig. 2. Oil price volatility for nine oil exporting non-democratic countries.

country by the average oil price per year in local currency. The oil revenue is then divided by the GDP of each country, so as to obtain the value of crude oil revenue as % of GDP. Finally, oil rents are also expressed as a percentage of GDP and they are measured annually. More specifically, oil rents (% of GDP) depict the difference between the value of crude oil production at world prices and total costs of production. In general, each of the three proxies introduced in this study have their own characteristics for oil dependence volatility and will reflect information that other proxies may not have the ability to do. While 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.

3.1.1. Oil price volatility

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

Hence, for oil price volatility, we implement the standard GARCH (1,1) model projected by Bollerslev (1986) and Chen and Hsu (2012) to generate conditional volatility:

$$LOG\left(\frac{P_t}{P_{t-1}}\right) = c_0 + \sigma_t z_t \tag{1}$$

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

where P_t reflects the monthly oil price at the given time t and σ_t^2 is the monthly conditional variance at time t, z_t identifies the sequence of identically distributed standardized residuals. As a result, the annualised

conditional volatility (OilV) is calculated as follows:

$$OilV = \sqrt{12 \sum_{t=1}^{\tau} \sigma_t^2}, \tag{3}$$

where $\tau = 12$ is the number of months per year.

We estimated the oil price volatility during the period of 1983 to 2016. Figs. 1 and 2 show the oil price volatility for oil-exporting democratic and non-democratic countries.

According to Figs. 1 and 2, in 1986, estimated oil price volatility is rising, which coincided with the 1986 oil price collapse because of the failure of OPEC[1] 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, 2009a, 2009b) 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).

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. The demand driven oil price shocks characterise in this period (Hamilton, 2009a, 2009b). This oil price shift led to a rise in oil price volatility in 2008, as seen in Fig. 2.

It is notable, there is no escalation of oil volatility from 2011 to 2014 when a number of geopolitical crisis for instance the Arab spring and the Libyan and Syrian civil wars happened. There is a spike in oil volatility in 2016 because it was the collapse of the oil prices in the last half of 2014 and 2016 (see Figs.1 and 2). 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

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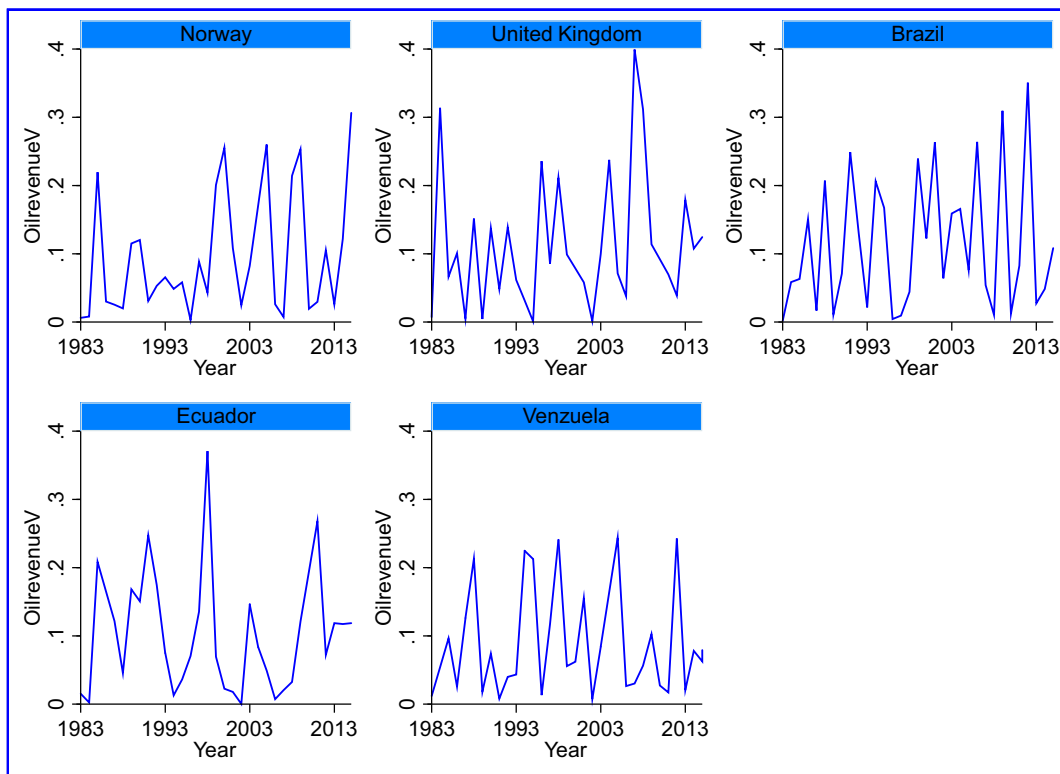[1] Organization of the Petroleum Exporting Countries

Fig. 3. Oil revenue volatility for five oil exporting democratic countries.
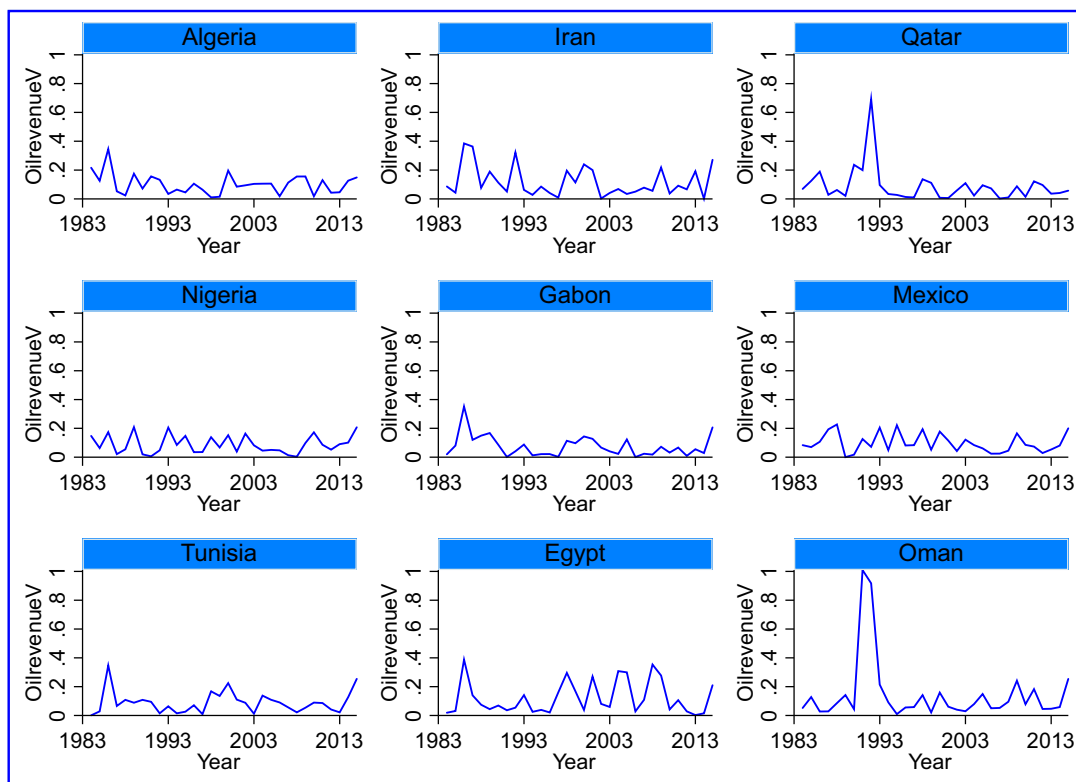

Fig. 4. Oil revenue volatility for nine oil exporting non-democratic countries.

2015 and the oil price volatility spike.

3.1.2. Oil revenue volatility

Unfortunately, crude oil export revenues are not available in higher frequency for sampled countries, so it is not possible to calculate vola-
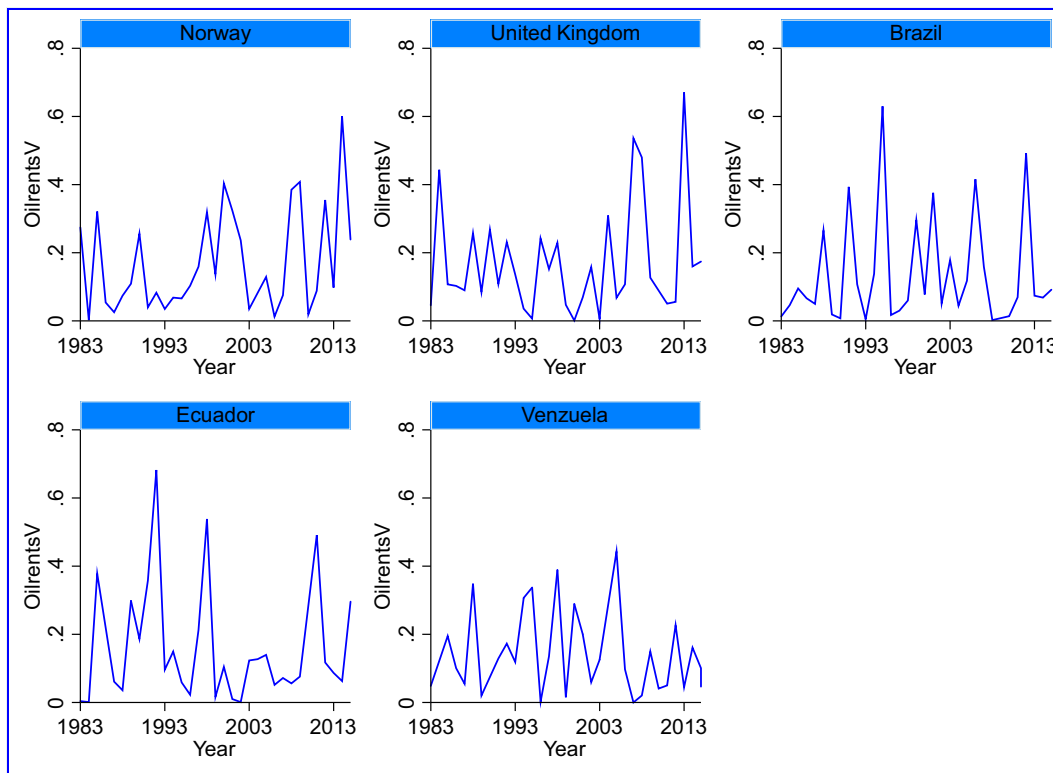
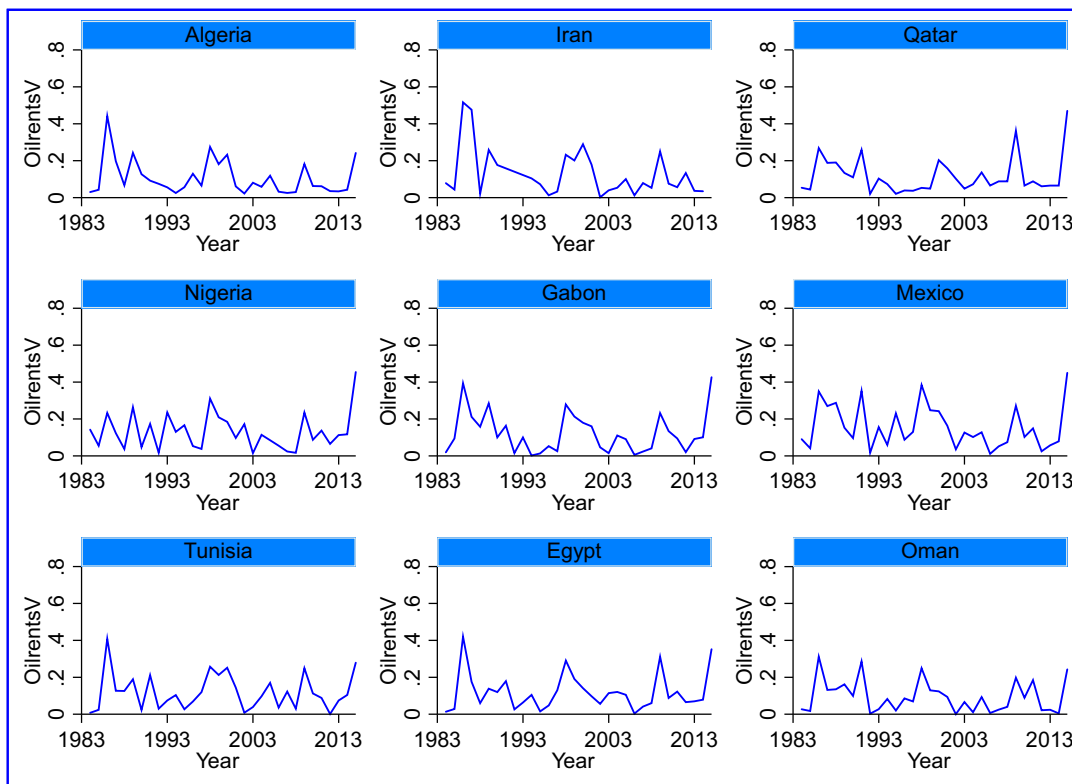**Fig. 5.** Oil rent volatility for five oil exporting democratic countries.

Fig. 6. Oil rent volatility for nine oil exporting non-democratic countries.

tility 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 of oil revenue series constructed from an annual basis of oil exports and oil price per year:

Table 1

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 2

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 dependence 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 dependence volatility 1: oil price volatility 2: oil revenue volatility 3: oil rent volatility

Note: Annual data14 countries for the period 1983–2016.

$$Oilrevenue V = ABS\left(LOG\left(\frac{RV_t}{RV_{t-1}}\right)\right) \qquad (4)$$

where RV_t is the revenue of oil exports. We plot the oil revenue volatility over the period of 1983 to 2016 in Figs. 3 and 4 for oil-exporting democratic and non-democratic countries.

Reference to Figs. 3 and 4, allows us to observe that oil revenue volatility during 1983 to 2016 for both of democratic and non-democratic countries is substantially lower than oil price volatility

3.1.3. Oil rent volatility

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, we measured oil rents volatility as oil revenue volatility, OilrentsV:

$$Oilrents V = ABS\left(LOG\left(\frac{OR_t}{OR_{t-1}}\right)\right) \qquad (5)$$

where OR_t is the oil rent.

The measure of oil rent volatility is shown in Figs. 5 and 6 which plots annually oil rent returns using absolute annual log-returns for oil-exporting democratic and non-democratic countries from 1983 to 2016.

According to Figs. 5 and 6, for most of the countries there are five significant peaks in oil rent volatility in 1986, 1991, 1999, 2009, and 2015. Coincidentally each of these peaks has been accompanied by the
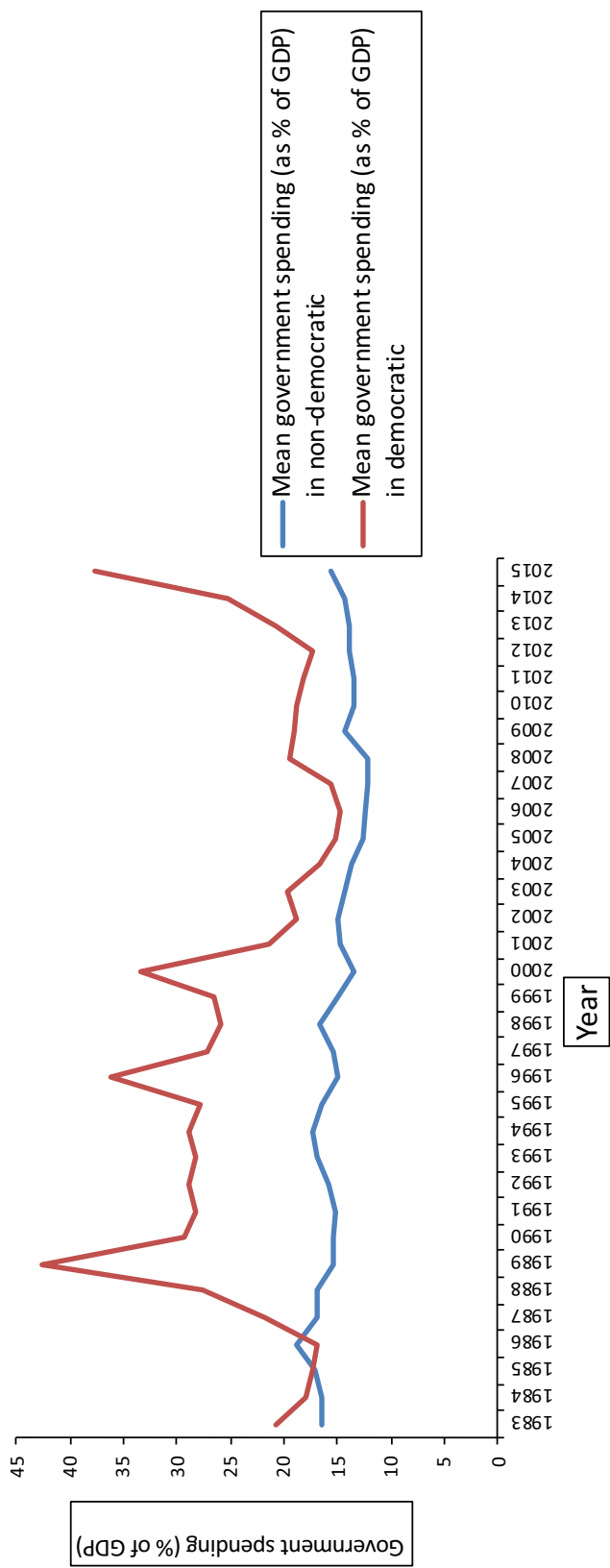

Fig. 7. Mean of general government spending (% of GDP) in democratic and non-democratic countries.
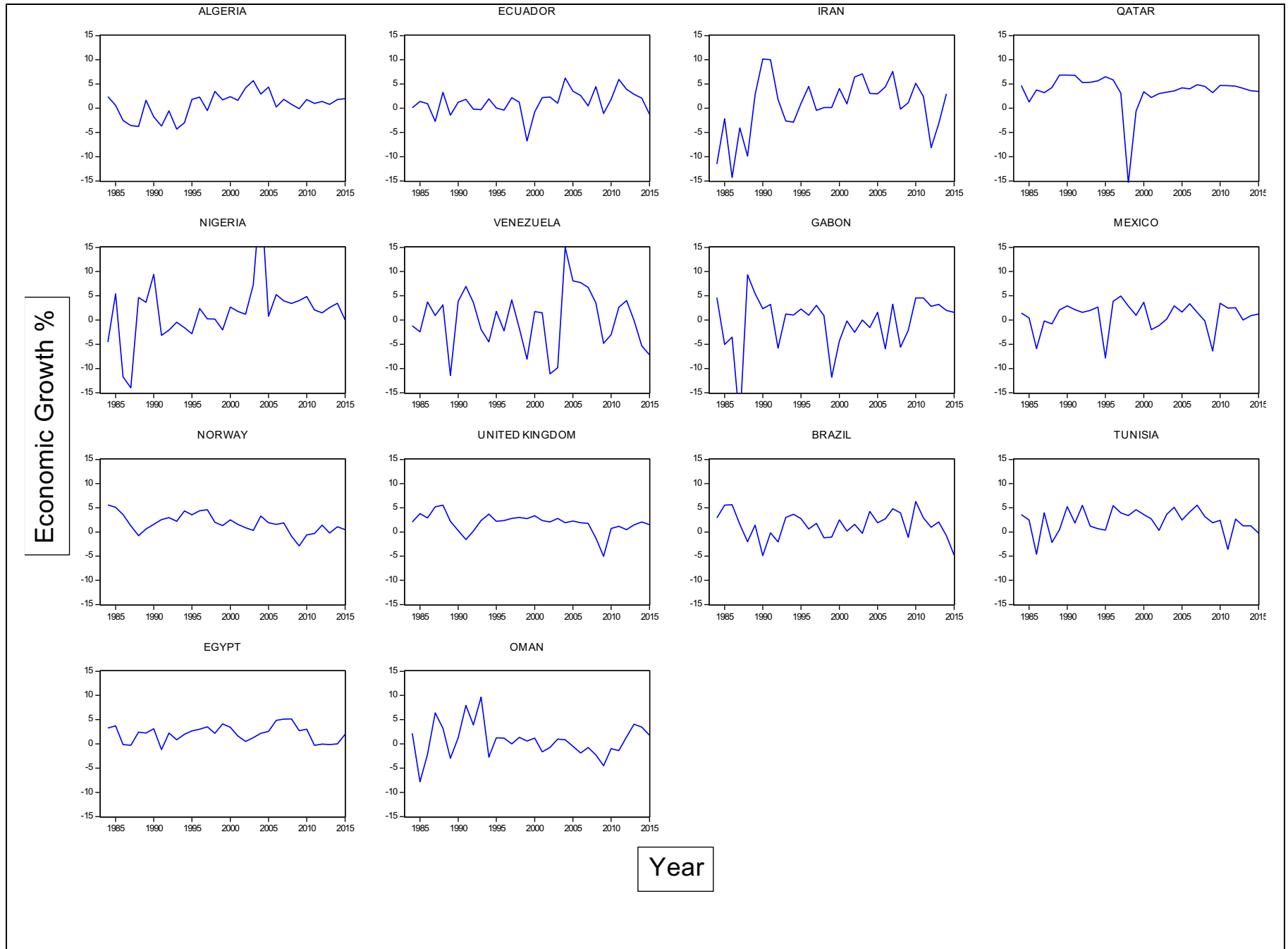
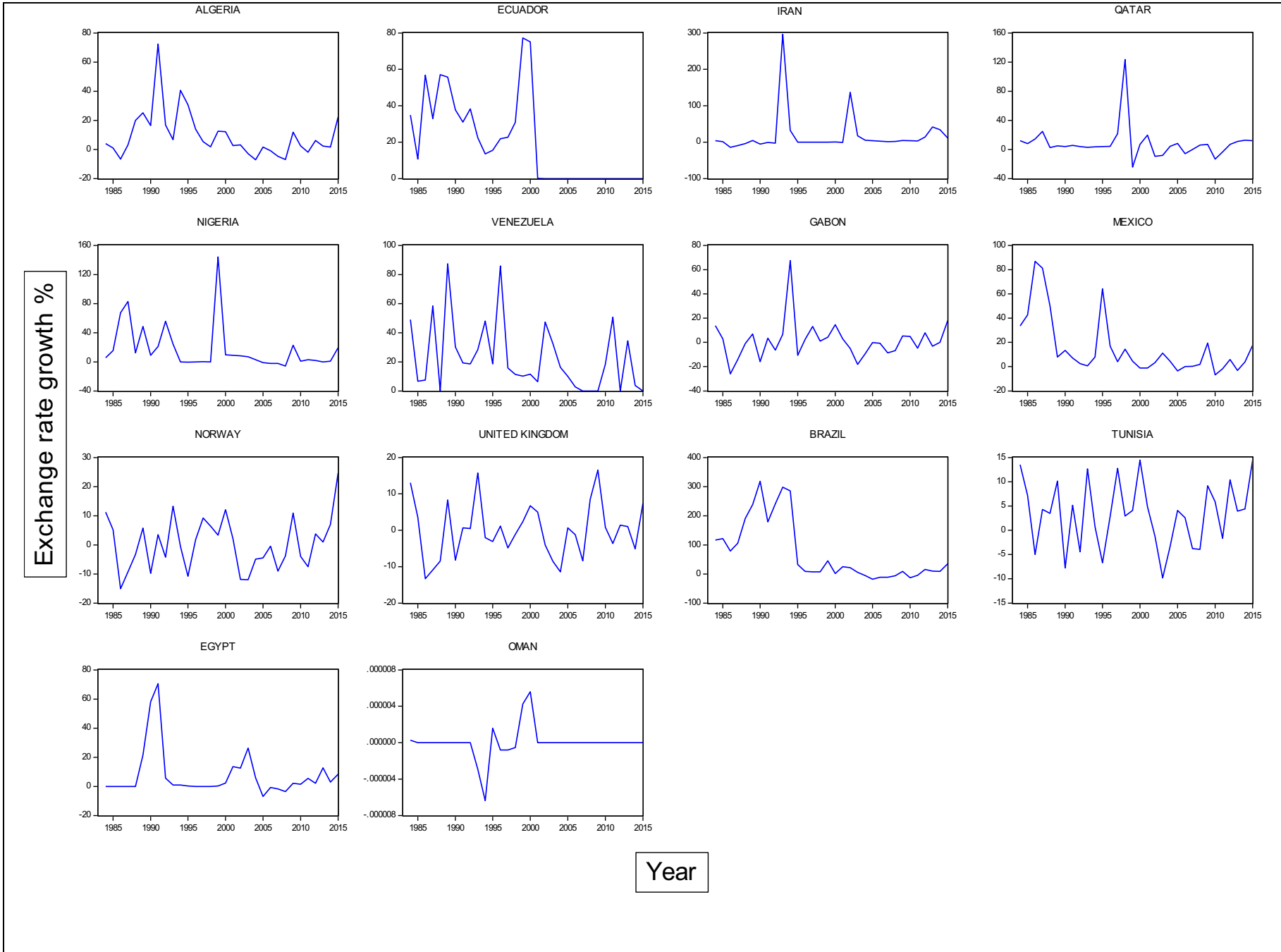**Fig. 8.** Economic growth in democratic and non-democratic countries.

Fig. 9. Exchange rate in democratic and non-democratic countries.
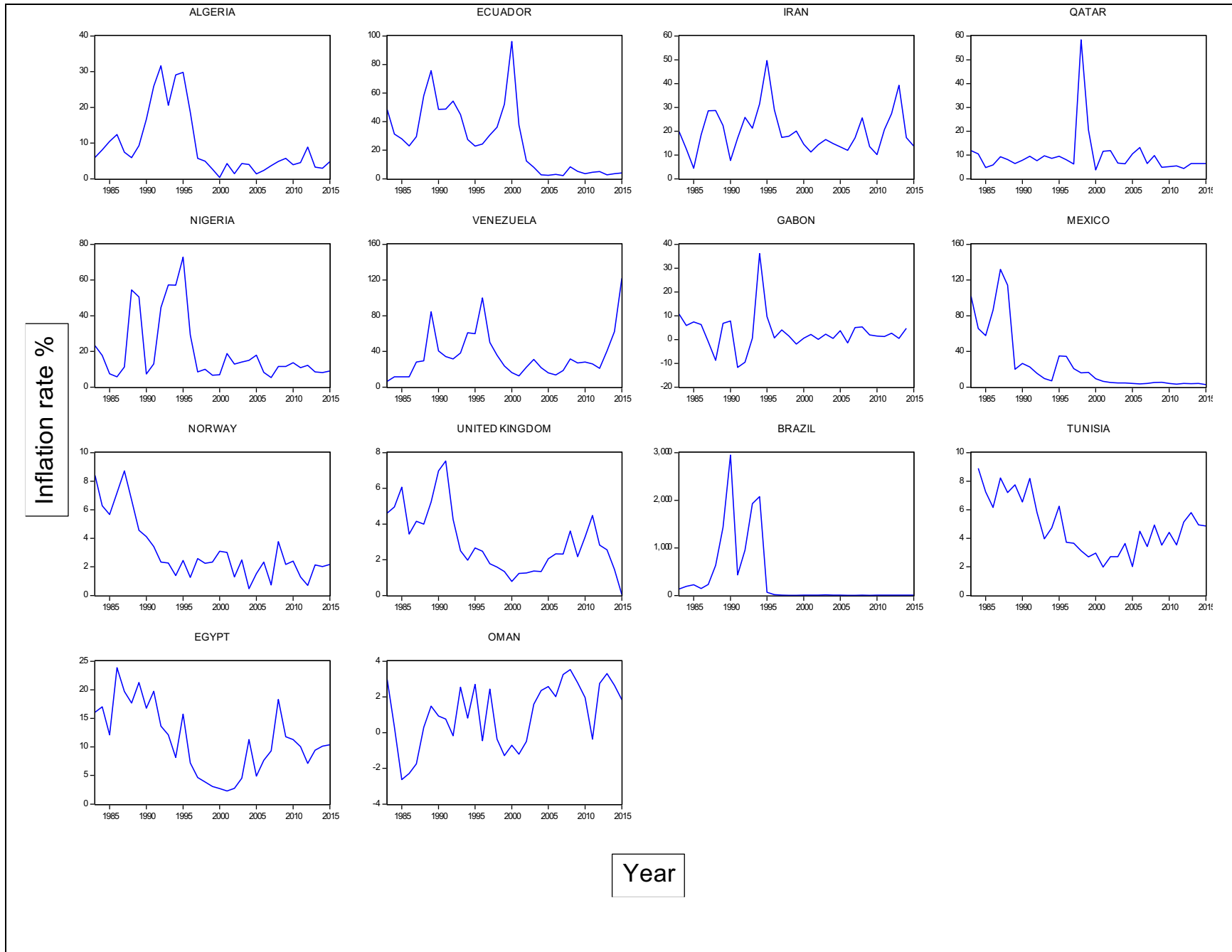
Fig. 10. Inflation rate in democratic and non-democratic countries.

Table 3

Descriptive statistics of the variables under examination. The sample period runs from 1983 to 2016.

	Mean	Minimum	Maximum	Std. Dev.	J-B	Obs.
Democratic countries (N = 5)						
OilV	1.29	0.31	2.62	0.54	19.06*	165
OilrevenueV	0.10	0.00	0.39	0.09	670.00*	160
OilrentsV	0.15	8.99	0.68	0.15	73.98*	158
GOV_EXP	13.78	2.27	121.73	2.14	151.02*	165
INF	3.54	0.05	47.68	3.86	482.76*	165
R_EXCH	0.72	−0.16	23.10	2.91	60.49*	160
R_GDP	0.01	−0.10	0.16	0.03	38.77*	160
Cross_1_1	1.29	0.31	2.62	0.54	840.46*	165
Cross_1_2	0.09	0.00	0.39	0.09	550.36*	164
Cross_1_3	0.15	0.00	0.68	0.15	61.74*	164
Cross_2_1	3.74	0.65	7.87	1.62	25.54*	165
Cross_2_2	0.28	0.00	1.19	0.26	43.32*	165
Cross_2_3	0.43	0.00	2.04	0.45	32.21*	165
Non-Democratic countries (N = 9)						
OilV	1.16	0.31	2.94	0.48	23.88*	297
OilrevenueV	0.10	0.00	1.00	0.11	5525.85*	288
OilrentsV	0.12	5.35E-05	0.51	0.10	209.28*	284
GOV_EXP	15.03	4.83	35.86	5.37	9.58*	297
INF	11.68	−11.68	131.82	16.56	33,977.29*	295
R_EXCH	0.17	−0.22	18.33	1.13	5058.08*	288
R_GDP	0.01	−1.00	0.30	0.07	50.34*	288
Cross_1_1	1.16	0.31	2.94	0.48	2.62*	297
Cross_1_2	0.10	0.00	1.00	0.11	157.98*	288
Cross_1_3	0.12	5.35E-05	0.51	0.10	396.65*	284
Cross_2_1	2.62	0.31	8.84	1.25	32.98*	296
Cross_2_2	0.23	0.00	3.02	0.30	34.87*	288
Cross_2_3	0.27	0.00	1.41	0.25	98.01*	284

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

Table 4

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.

sudden rises and falls of oil prices, as reviewed in Section 3.1.1. 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 caused a rise to 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.

3.2. 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.

In 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 1. (See Table 2.)

The democracies and non-democracies are computed as the Polity IV average over the sample period, scores that domain from +6 to +10 shows democracies, and rest nations with an average value from −10 to

Table 5
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.

+5 are regarded as non-democracies (see Table 1).

3.3. Quality of political institutions

The Polity IV is employed proxy for quality of political institutional in several studies (Bhattacharyya and Hodler, 2010; Bjorvatn et al., 2012; El Anshasy and Katsaiti, 2013; Boschini et al., 2013; Caselli and Tesei, 2016; Antonakakis et al., 2017a, 2017b). The Polity IV index assigns annual scores to individual country, domaining between −10 and +10. According to the index (Antonakakis et al., 2017a, 2017b), values that domain from +6 to +10 indicates democracies, with those countries scoring between +6 to +9 identified as flawed democracies, and those countries with a value of +10 are observed as full democracies. However, a value from −5 to +5 is assigned to these countries which are remarked as anocracies, while a value from −10 to −6 is specified to autocratic regimes.

3.4. Interaction terms

When an independent index has a diverse impact on the result depending on the scores of another independent index, an interaction occurs. In this situation adding interaction terms to a regression method can significantly develop considerate of the relations between the variables in the model and allows further hypotheses to be examined (Antonakakis et al., 2017a, 2017b). Therefore, we additional apply an interaction term among the oil dependence volatility and restraints to the executives, therefore as to account for the interdependencies between the quality of political institutions, government spending, subcategories of government spending and oil dependent volatility. Moreover, we employ an interaction term among oil dependent volatility and the 'Regulation of Chief Executive Recruitment' (CROSS_1_i), which allows the distinction between democratic and non-democratic classification. In addition, the Polity IV index represents a value for the range to which institutionalised methods are set in place for shifting executive authority and which is abbreviated as XRREG. The value domains among 1 and 3, with 1 representing no restraint to the executives, 2 representing a shift phase and 3 representing restraints to the executives. Based on the XRREG we will create another interaction term (CROSS_2_i) to assess whether the restraints to the executives performance a role in the transmission mechanism between oil volatility and government spending.

3.5. Choice of macroeconomics variables

We collect annual data for the following economic variables. We use the real GDP per capita (in 2010 US$), nominal exchange rate (LCU)[2] per US$ (so an increasing value denotes depreciation of the domestic currency), CPI inflation (annual %) and general government spending (as % of GDP).

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

$$growth_t = ln(Z_t) - ln(Z_{t-1}) \tag{6}$$

where Z_t represents the present value and Z_{t-1} shows the past value at the given time t.

3.5.1. General government spending (% of GDP)

The key variable of interest is general government spending (% GDP) and it provides an indication of the size of government across countries. As shown in the literature review section, government spending is heavily dependent on the oil sector in oil exporting countries, (some indicative studies include Dées et al., 2008; Farzanegan and Markwardt, 2009; Hamdi and Sbia, 2013). Therefore, the government spending behaviour can be significantly changed based on any change in oil prices and associated increase or decrease in oil price volatility (Fasano-Filho and Wang, 2002; Bondzie et al., 2014; Pazouki and Pazouki, 2014). Fig. 7 shows the average of general government spending (% GDP) in oil exporting democratic and non-democratic countries from 1983 to 2016.

If we look at the general government spending (US $) and GDP (US $), we 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 are 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 are faced with an increasing government spending that caused a rise in their government spending (as % of GDP).

3.5.2. GDP

Oil price changes and fluctuations has a foremost effect on economic growth. These effects are anticipated to be different in oil importing and oil exporting nations. As a matter of fact, an oil price rise is remarked 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 relation among economic growth and government spending and there are studies that show bi-directional causality between them (Abu-Bader and Abu-Qarn, 2003). Hence, in order to avoid the so-called "omitted-variable bias", we will employ GDP growth as an additional variable in our econometric models.

Fig. 8 illustrates the economic growth in selected oil exporting democratic countries from 1983 to 2016. Therefore, economic growth fluctuates dramatically in Iran, Qatar, Nigeria, Venezuela, and Gabon but not in other oil countries.

3.5.3. Exchange rate

Backus and Crucini (2000) suggest that the increased volatility in the terms of trade is largely as a result of the increased volatility in the relative oil price. Moreover, literature identified the terms of trade as one of the possible elements of the real exchange rate (Habib and Kalamova, 2007). Several practical studies find a substantial association

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[2] Local Currency Units

Direct effects

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

Accumulated Response of GOV_EXP to CROSS_1_1
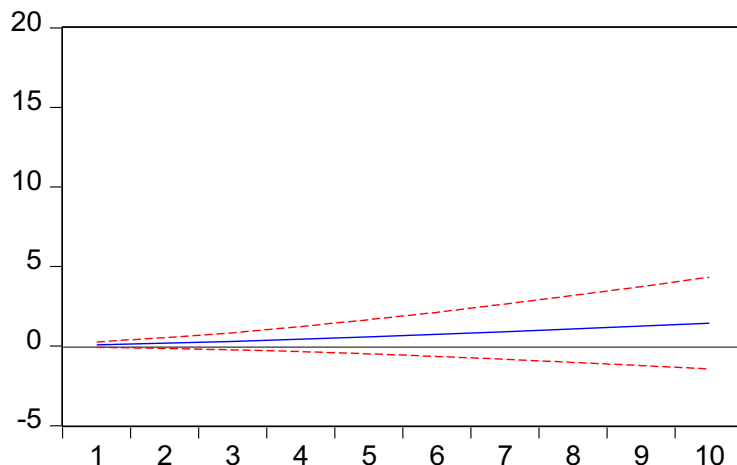
Indirect effects

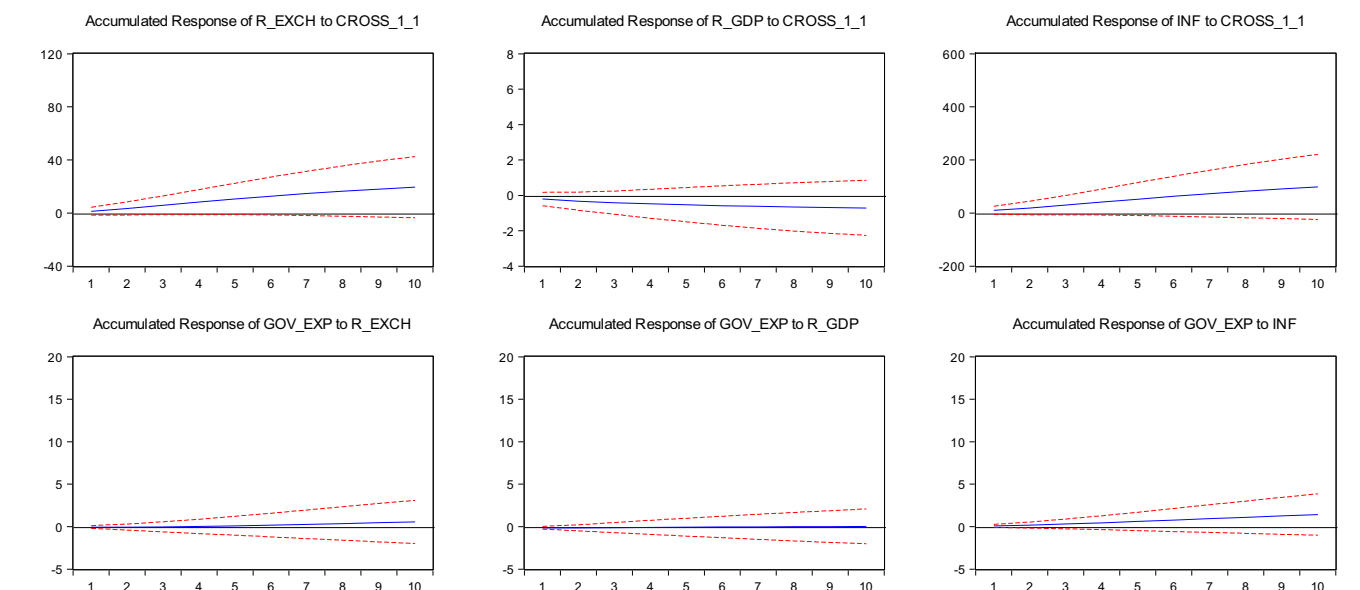Accumulated Response to Generalised One S.D. Innovations±2 S.E.

Fig. 11. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut0dem1) on government spending in Democratic countries.

among 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 there is a highly volatile in the oil market, currencies follow an "oil currency" regime; terms-of-trade being a vital driver of the real exchange rate.

The growth of exchange rates in oil-selected countries is shown in Fig. 9. 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 crises. For instance, oil prices commenced to increase gradually in late 2003 from about $30 per barrel till they peaked at $140 per barrel in the middle of 2008. Additionally, Nigeria gained its $18 billion debt relief from the Paris Club through increasing oil prices period. It was a substantial economic bonus. Thus, increasing oil prices permitted Nigeria's foreign reserves to rise noticeably.

3.5.4. 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 evidence that inflation might cause government revenue to fall and budget deficits to rise due to the tax effect, and the consequent monetization could lead to even higher rates of inflation (Alavirad, 2003).

Fig. 10 shows the inflation rate in oil-exporting democratic and non-democratic countries. The inflation rate is increased in Brazil sharply. Therefore, the Brazilian economy suffered from predominant inflation during the 1980s and 1990s. The government introduced the Plano Real after quite a lot of failed economic initiatives in 1994. This strategy provided stability and allowed Brazil to outperform the economy over that of the world economy during the next decade. Despite this quick
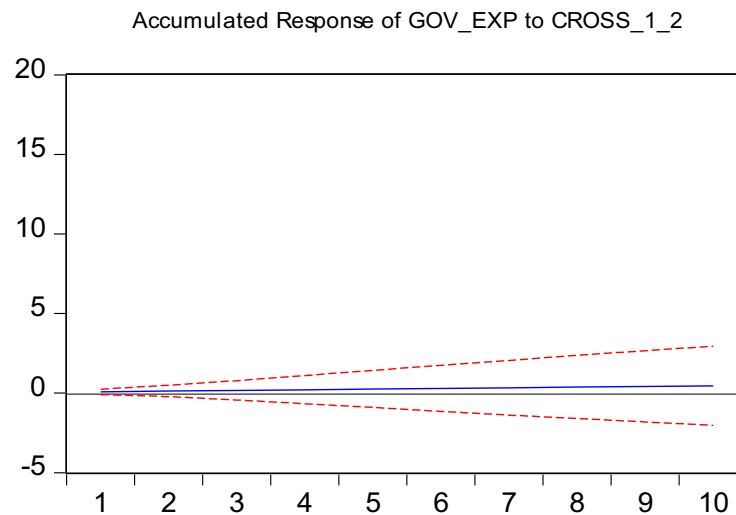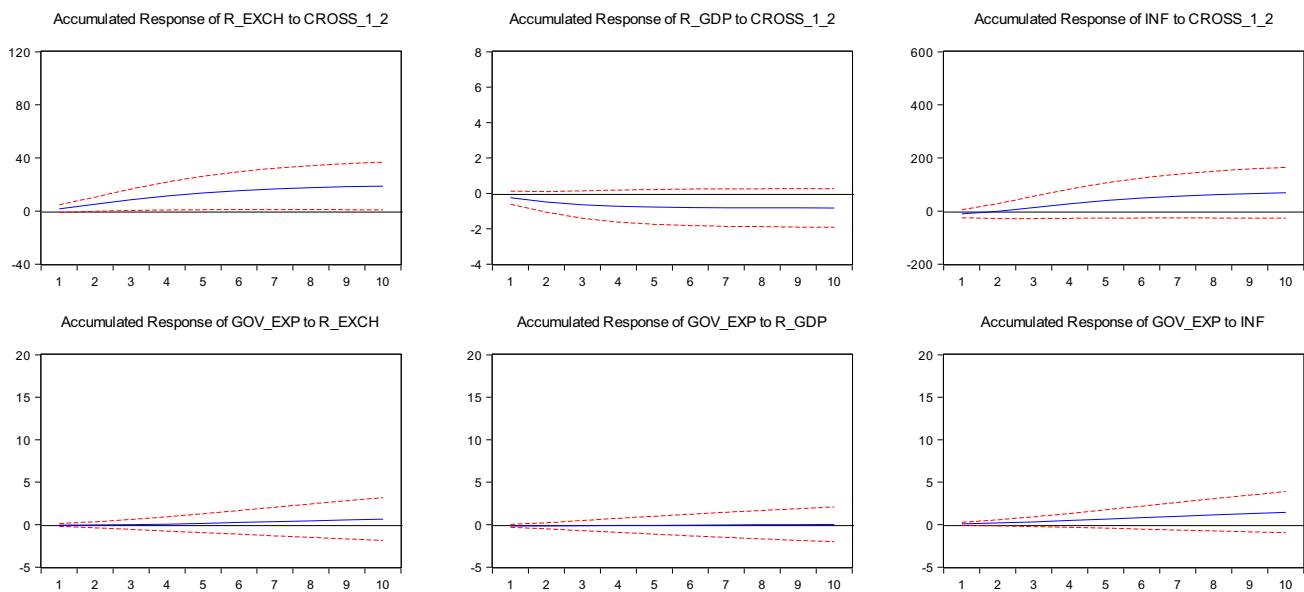
Fig. 12. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut0dem1) on government spending in Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_1_2 = (OilrevenueV_aut0dem1), GOV_EXP = government spending.

development, corruption, violent crime, functional illiteracy, and poverty continue to plague the country.

4. Methodology

The Panel Vector Autoregressive (PVAR) model is applied in this study to examine the relationship between oil and macroeconomic variables. This technique has been employed mostly to analyse macroeconomic panel data and it was originally developed by Holtz-Eakin et al. (1988). According to Antonakakis et al. (2017a, 2017b), the PVAR model combines the traditional VAR approach Sims (1980) and it considers all system variables to be endogenous, with the panel-data method, which allows for unobserved individual heterogeneity.

In its general form, our model can be written as follows:

$$Y_{it} = A_0 + A_1 Y_{it-1} + A_1 Y_{it-2} + \ldots A_j Y_{it-j} + \mu_i + \varepsilon_{it} \tag{7}$$

where 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$) (R_GDP), nominal exchange rate (LCU) per US$ (R_EXCH), inflation consumer prices (INF) and general government spending (GOV_EXP). The $(m \times m)$ matrices $A_0, A_1, \ldots, A_{j-1}, A_j$ is parameters to be estimated. μ_i accounts for the country fixed effects. Finally, ε_{it} denotes the error term (Antonakakis et al., 2017a; Antonakakis et al., 2017b).

We use a panel generalised impulse-response function (PGIRF) analysis, which is based on Pesaran and Shin (1998) and gives a solution

Direct effects

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

Accumulated Response of GOV_EXP to CROSS_1_3
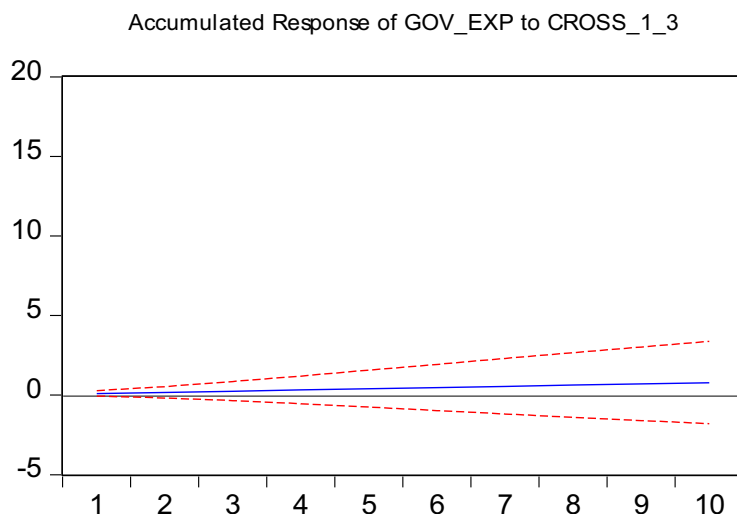
Indirect effects

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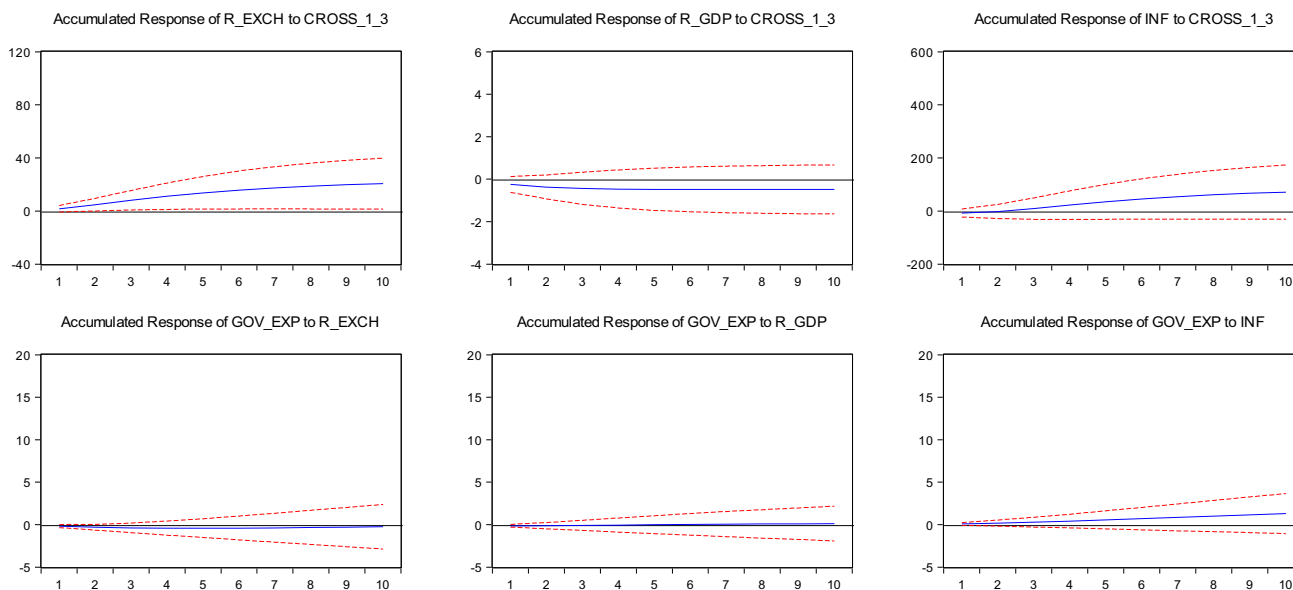

Fig. 13. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut0dem1) on government spending in Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_1_3 = (OilrentV_aut0dem1), GOV_EXP = government spending.

when a theory does not offer clear cut control on the ordering of variables, to acquire a thorough picture of the dynamic interactions. Furthermore, the PGIRFs are deconstructed into shock responses to individual variables by removing the effects of shocks on all other variables, providing additional insight into the transmission mechanisms at work (Antonakakis et al., 2017a).

According to Antonakakis et al. (2017a, 2017b) 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. (1988) 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
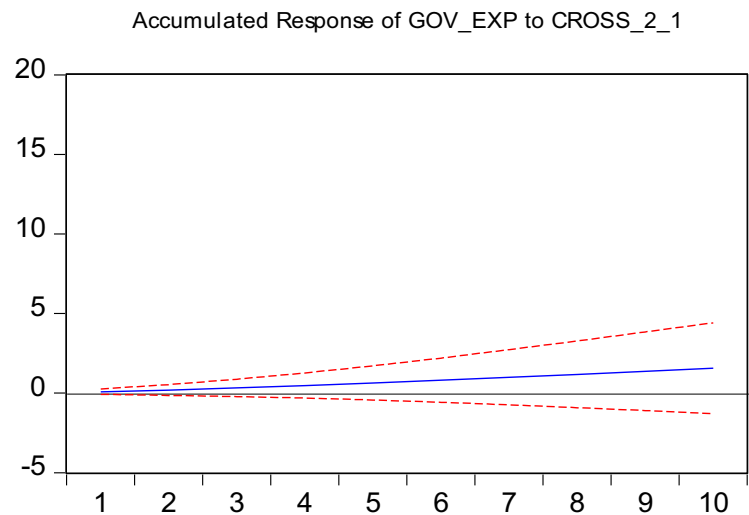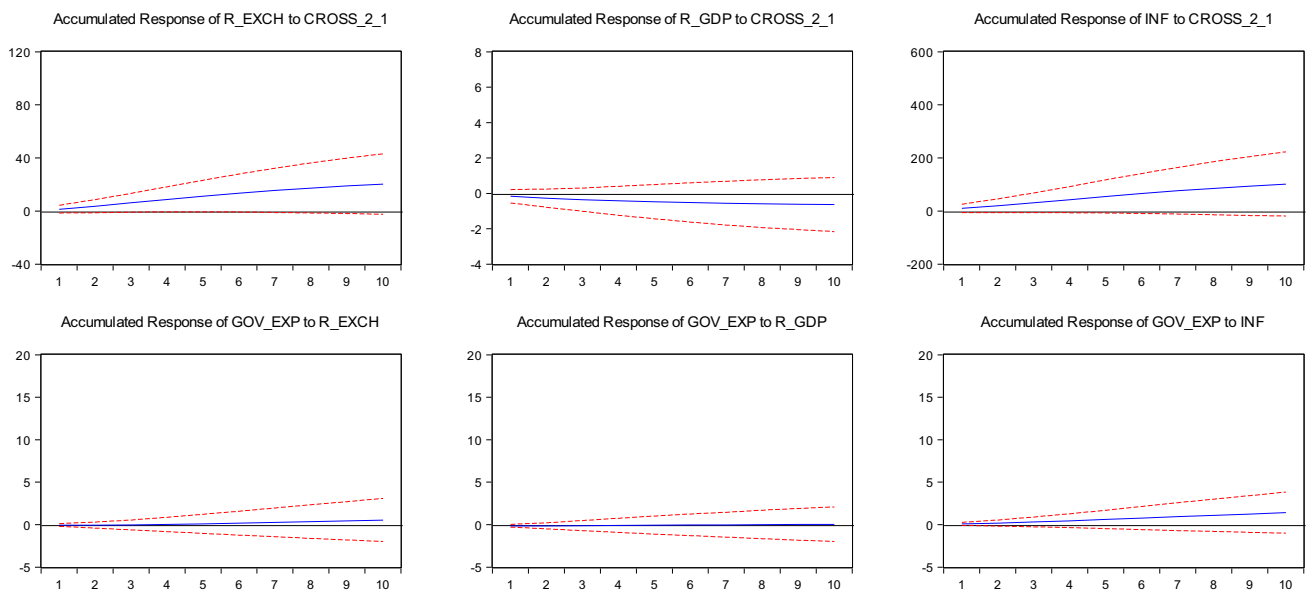
Fig. 14. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut0dem1xrreg) on government spending in Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_1 = (OilV_aut0dem1xrreg), GOV_EXP = government spending.

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 among variables in the structure (Tiwari, 2011; Omojolaibi and Egwaikhide, 2014).

4.1. Descriptive statistics

Table 3 presents the descriptive statistics of the full data sample. Some facts can be revealed from Table 3:

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 oil revenue volatility in the non-democratic group is larger, this result suggests that the variation of oil revenue volatility in this group is more than in democratic 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

Direct effects

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

Accumulated Response of GOV_EXP to CROSS_2_2
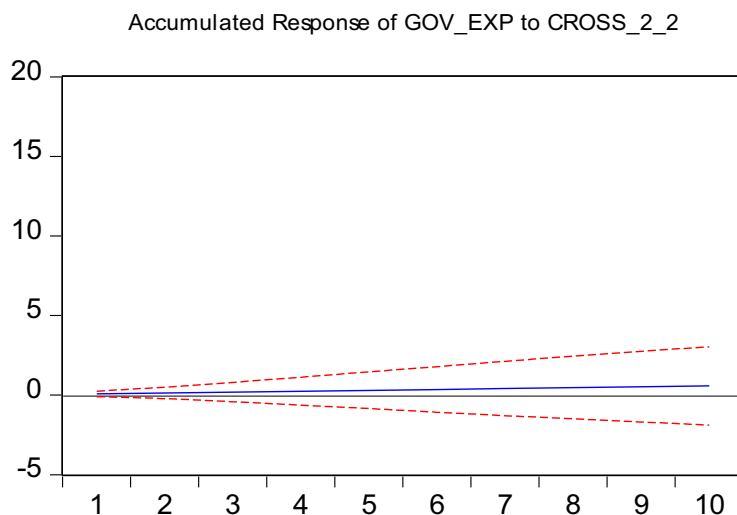
Indirect effects

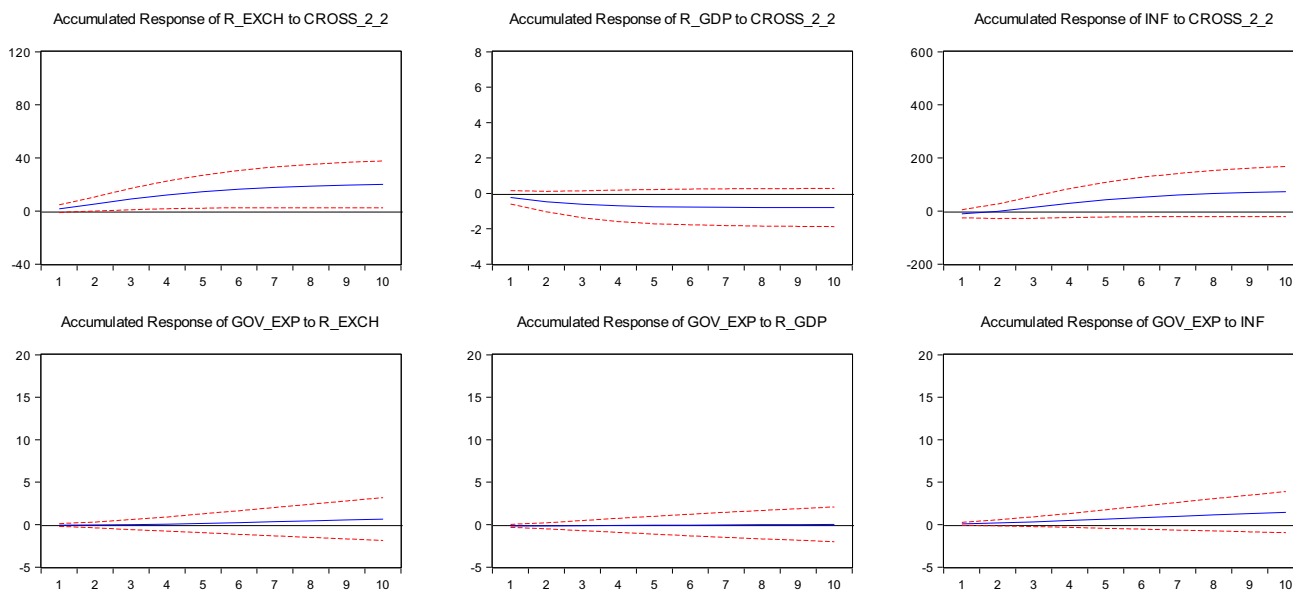## Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.

Fig. 15. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut0dem1xrreg) on government spending in Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_2 = (OilrevenueV_aut0dem1xrreg), GOV_EXP = government spending.

proxies, oil rent volatility is smaller but more variable than oil revenue volatility for both groups of countries.

5. The means of inflation and government spending 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 inflation and government spending in non-democratic group is higher than democratic members.

4.2. Unit root test

To estimate the PVAR model, we will first determine whether the variables are stationary or not. For this purpose, this study employs panel unit root tests developed by Levin et al. (2002) and Im et al. (2003). In Table 4, 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).

4.3. Panel Granger causality test

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

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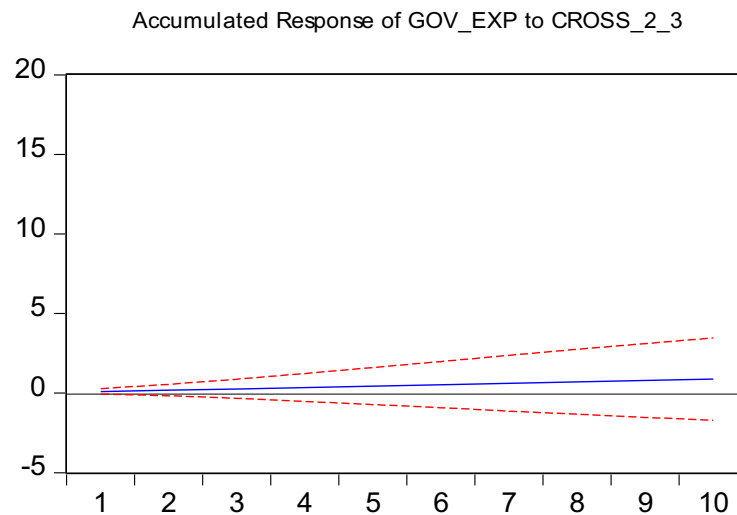
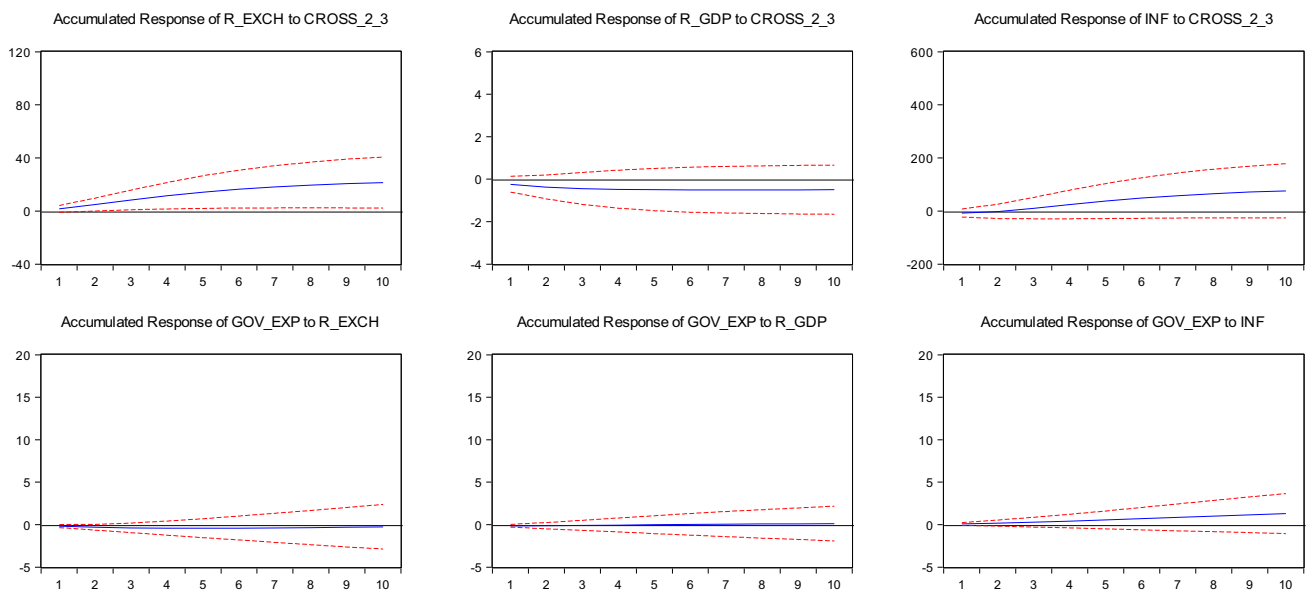Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.

Fig. 16. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut0dem1xrreg) on government spending in Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_3 = OilrentsV_aut0dem1xrreg, GOV_EXP = government spending.

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.

A very important point in understanding oil volatility 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:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \gamma^{(k)} y_{it-k} + \sum_{k=1}^{K} \beta^{(k)} x_{it-k} + e_{it} \qquad (8)$$

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 $\beta^{(1)} = \ldots = \beta^{(k)} = 0$ against the causality from x to y for all the cross-sectional units (Lin and Ali, 2009).

The results of the Panel Granger causality test are reported in

Direct effects

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

Accumulated Response of GOV_EXP to CROSS_1_1

Indirect effects

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

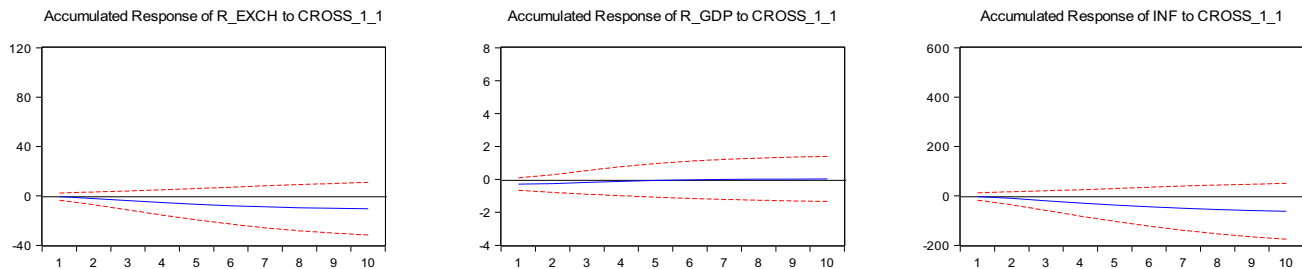| Accumulated Response of R_EXCH to CROSS_1_1 | Accumulated Response of R_GDP to CROSS_1_1 | Accumulated Response of INF to CROSS_1_1 |
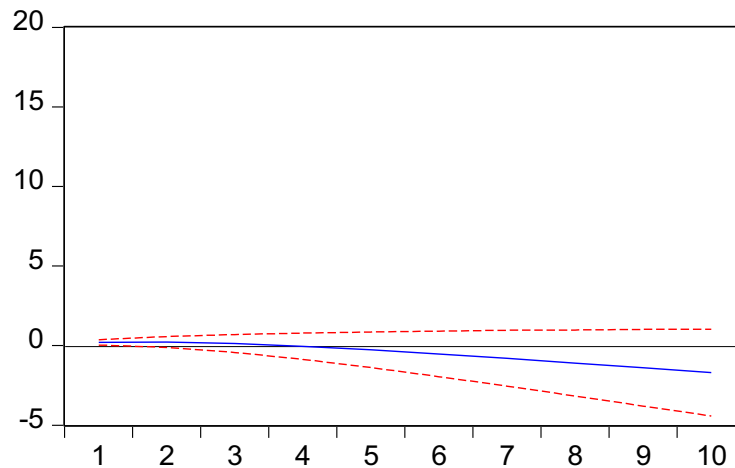
Fig. 17. Cumulative generalised impulse responses of Cross_1_1 (OilV_aut1dem0) on government spending in non-Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_1_1 = (OilV_aut1dem0), GOV_EXP = government spending.

Table 5. 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.

5. Empirical results

In this research, we apply a panel Vector Auto-Regressive (PVAR) approach along with panel impulse response functions from the period 1983 to 2016. Also, we use Generalised 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).

5.1. Democratic countries and government spending

This section examines the response of government spending to oil dependence volatility in oil-exporting countries that are categorized as democratic based on the definition given in Section 2.2. In the next section, this issue will be addressed in the category of non-democratic countries, and the results compared.

5.1.1. Responding to oil volatility shocks on government expenditure (Cross_1_1)

The results in Fig. 11, 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. 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. 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.

Therefore, oil price volatility can affect government expenditure, as a percentage of GDP, in democratic countries.
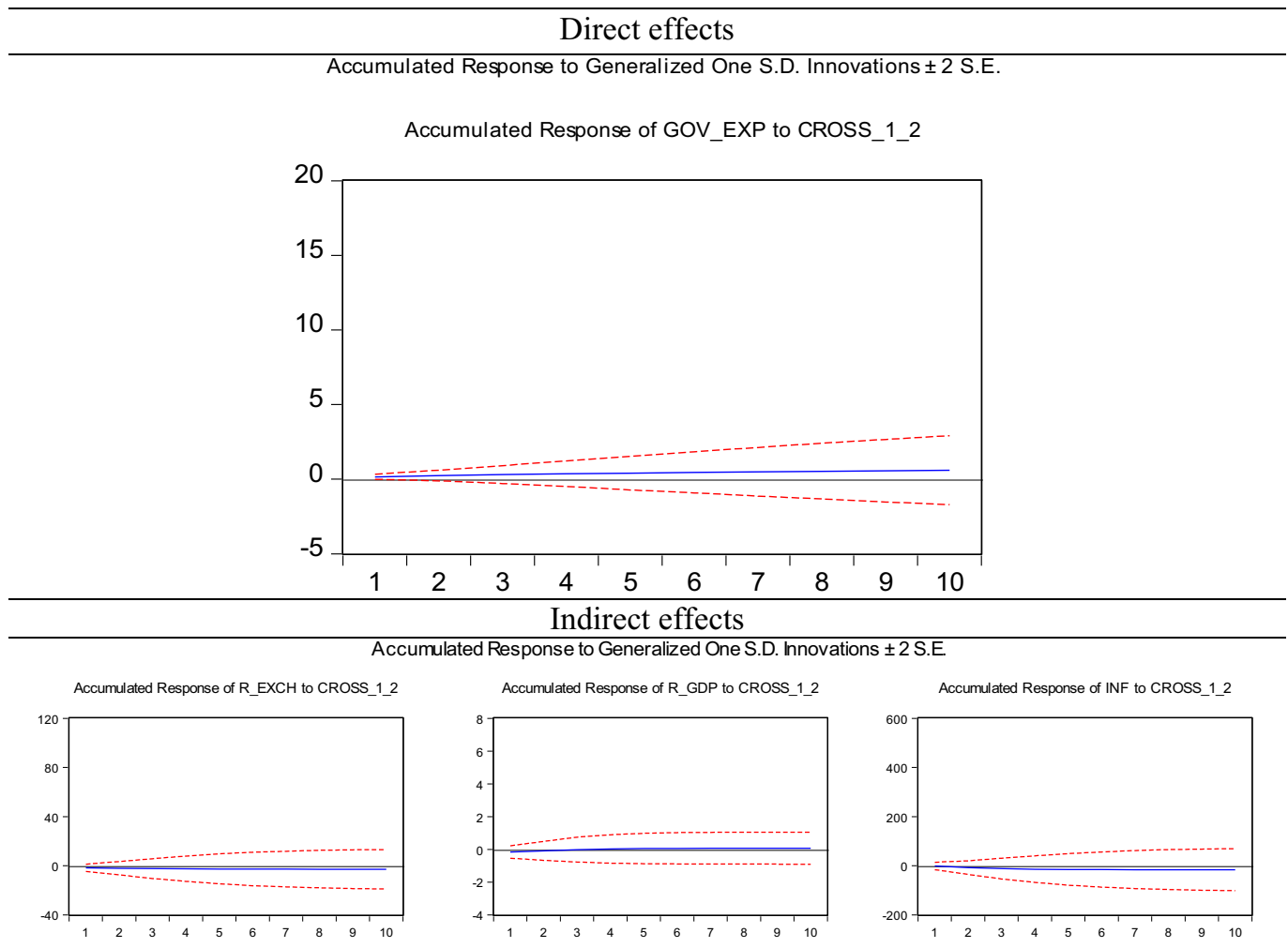
Direct effects

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

Accumulated Response of GOV_EXP to CROSS_1_2

Indirect effects

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

Fig. 18. Cumulative generalised impulse responses of Cross_1_2 (OilrevenueV_aut1dem0) on government spending 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 spending.

5.1.2. Responding to oil revenue shocks on government expenditure (Cross_1_2)

The direct and indirect effect of oil revenue volatility shocks on government expenditure in democratic countries is reported in Fig. 12. The findings suggest that Cross_1_2 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 impacts GOV_EXP. These effects are propagated via the effects of Cross_1_2 on inflation. The results show that the Cross_1_2 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.

5.1.3. Responding to oil rents shocks on government expenditure (Cross_1_3)

According to Fig. 13, 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. 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.

5.1.4. Responding the degree of constraints on the executive in the effect of oil price volatility on the share of government expenditure (Cross_2_1)

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. Fig. 14 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.

5.1.5. Responding the degree of constraints on the executive in the effect of oil revenue volatility on the share of government expenditure Cross_2_2

According to the results in Fig. 15, 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.
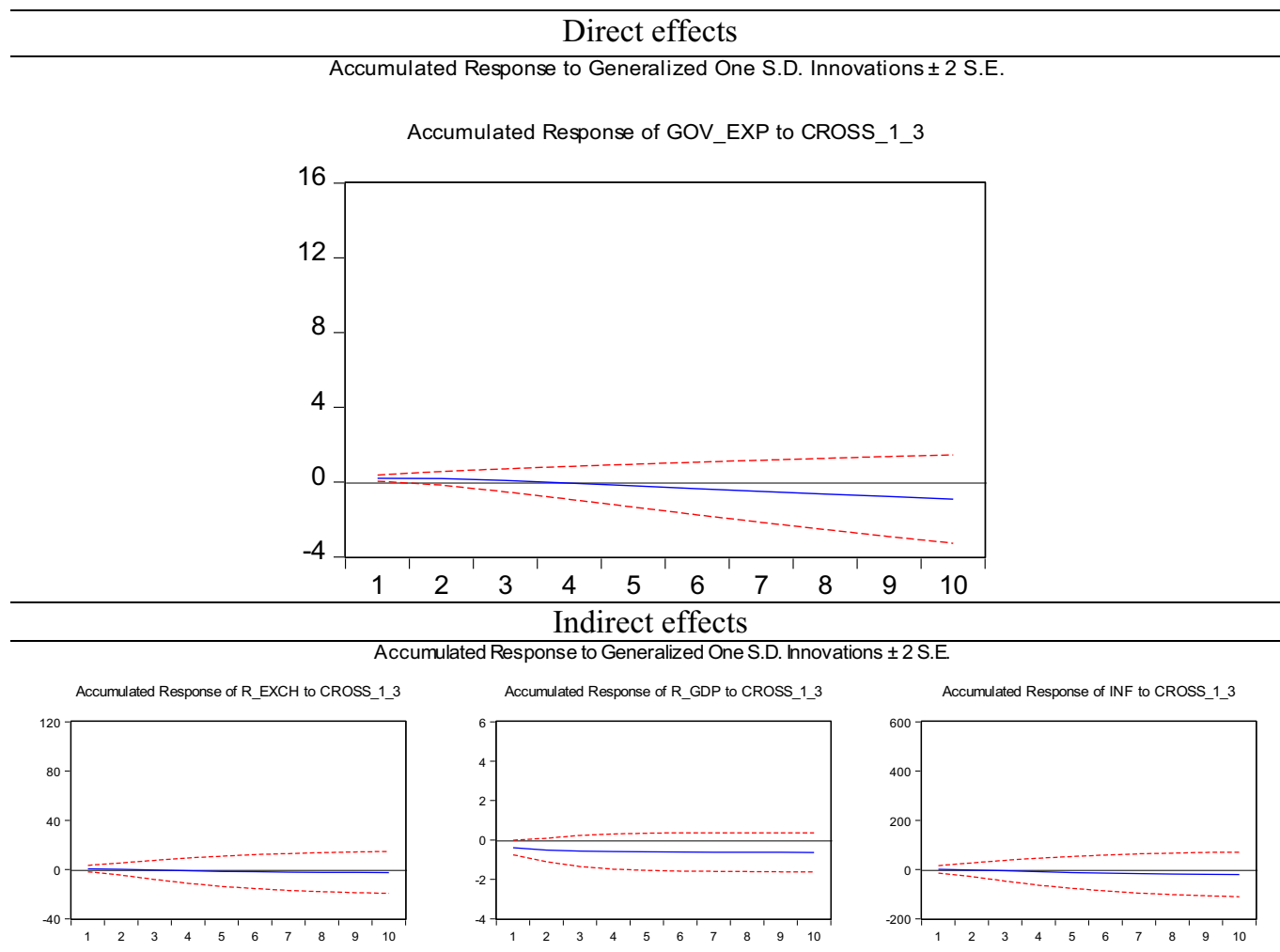
Direct effects

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

Accumulated Response of GOV_EXP to CROSS_1_3

Indirect effects

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

Accumulated Response of R_EXCH to CROSS_1_3

Accumulated Response of R_GDP to CROSS_1_3

Accumulated Response of INF to CROSS_1_3

Fig. 19. Cumulative generalised impulse responses of Cross_1_3 (OilrentV_aut1dem0) on government spending 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 spending.

5.1.6. Responding the degree of constraints on the executive in the effect of oil volatility on the share of government expenditure (Cross_2_3)

In Fig. 16, 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.

5.2. Non-democratic countries and government spending

In this section we will examine the effects of oil dependence 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.

5.2.1. Responding to oil price shocks on government expenditure (Cross_1_1)

As shown in Fig. 17, 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. This result may be related to the behaviour 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. (See Figs. 18–20.)

5.2.2. Responding to oil revenue shocks on government expenditure (Cross_1_2)

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. 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.
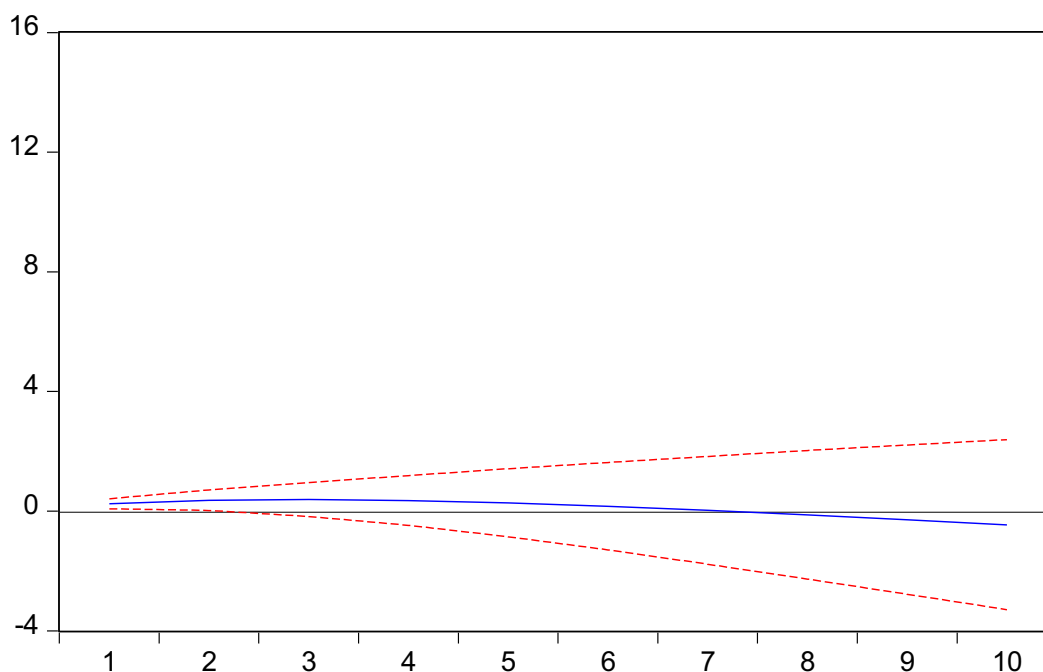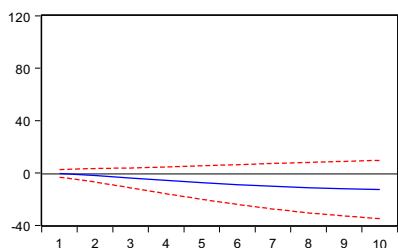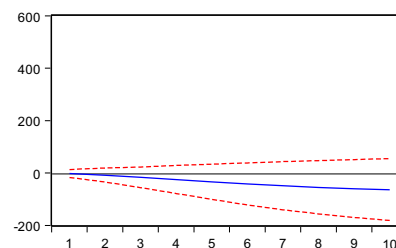
Fig. 20. Cumulative generalised impulse responses of Cross_2_1 (OilV_aut1dem0xrreg)on government spending in non-Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_1 = OilV_aut0dem1, GOV_EXP = government spending.

5.2.3. Responding to oil rents shocks on government expenditure (Cross_1_3)

The results related to oil rent volatility are identical to the case of oil price volatility. 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.

5.2.4. Responding the degree of constraints on the executive in the effect of oil price volatility on the share of government expenditure (Cross_2_1)

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). 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.

5.2.5. Responding the degree of constraints on the executive in the effect of oil revenue volatility on the share of government expenditure (Cross_2_2)

In Fig. 21, 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. 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. (See Fig. 22.)

5.2.6. Responding the degree of constraints on the executive in the effect of oil rents volatility on the share of government expenditure (Cross_2_3)

Using multiplicative variables of xrreg, inclusive of the degree of constraint on the executive in non-democratic countries in relation to

Direct effects

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

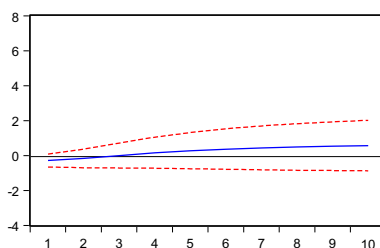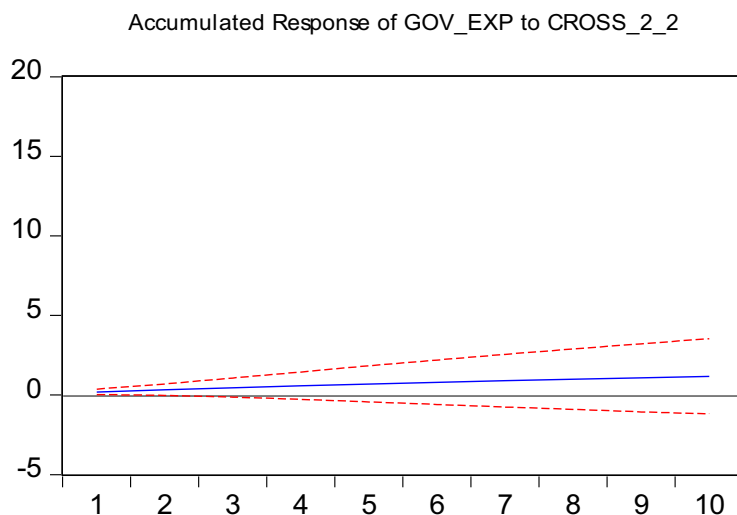Accumulated Response of GOV_EXP to CROSS_2_2

Indirect effects

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

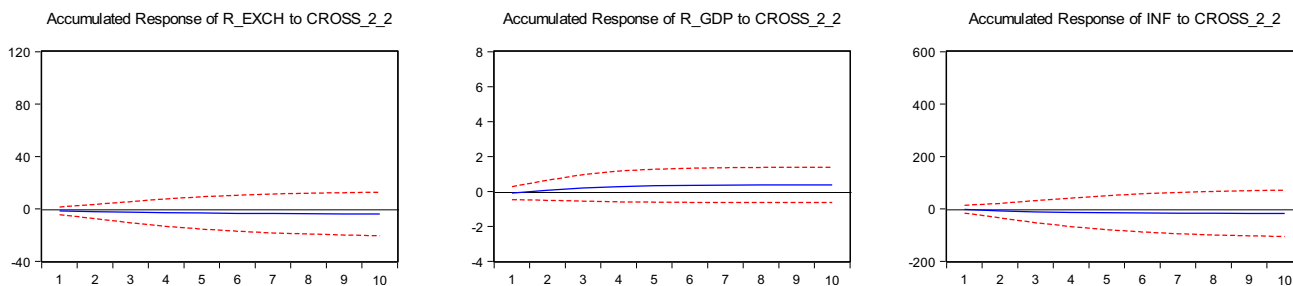| Accumulated Response of R_EXCH to CROSS_2_2 | Accumulated Response of R_GDP to CROSS_2_2 | Accumulated Response of INF to CROSS_2_2 |

Fig. 21. Cumulative generalised impulse responses of Cross_2_2 (OilrevenueV_aut1dem0xrreg)on government spending in non-Democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_2 = OilrevenueV_aut1dem0, GOV_EXP = government spending.

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. 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.

6. Discussion

Following our examinations of the differences of oil volatility shocks in democratic and non-democratic countries, the main results are as follows.

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.

Areski 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

Direct effects

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

Accumulated Response of GOV_EXP to CROSS_2_3
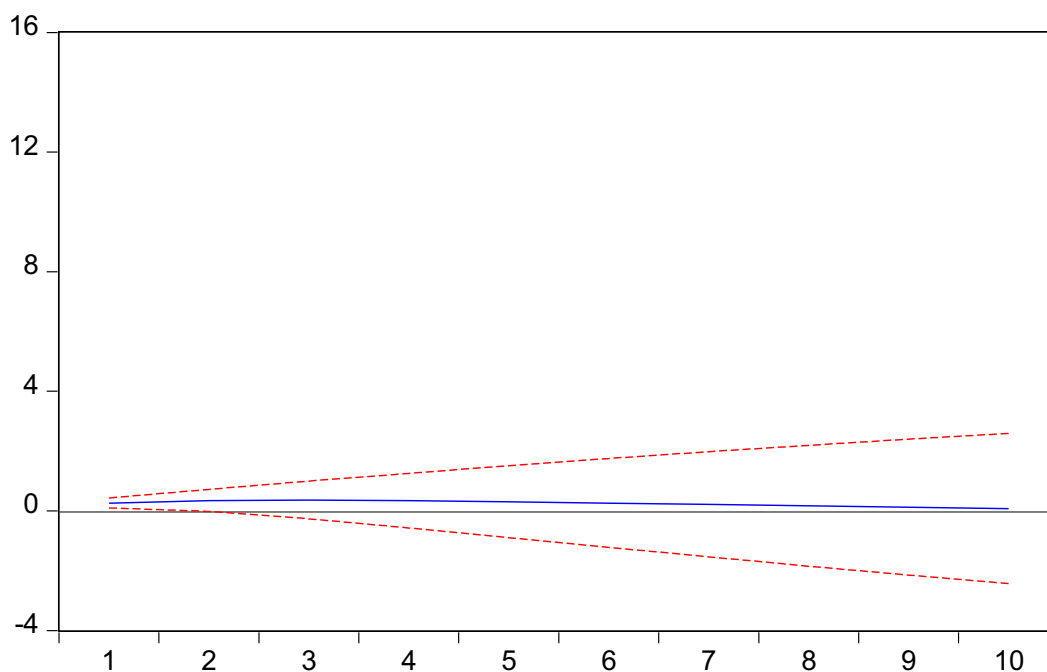
Indirect effects

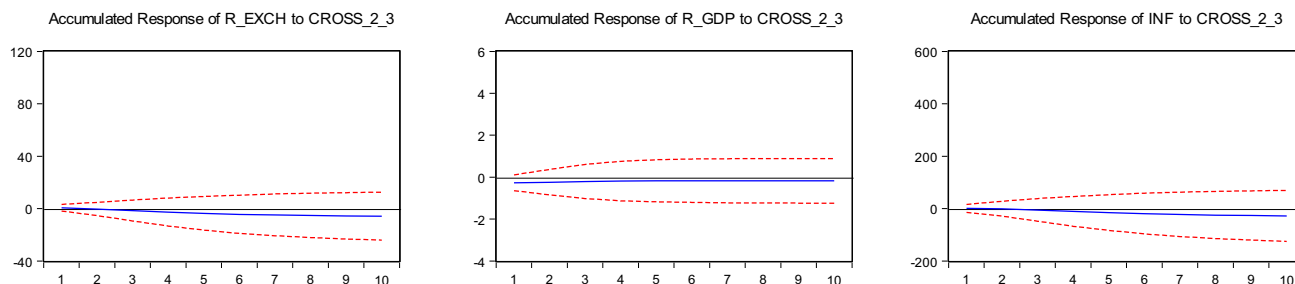Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.

Fig. 22. Cumulative generalised impulse responses of Cross_2_3 (OilrentV_aut1dem0xrreg)on government spending in Non-democratic countries.
Note: R_EXCH = exchange rate, R_GDP = GDP per capita, INF = inflation rate, CROSS_2_3 = OilrentV_aut1dem0, GOV_EXP = government spending.

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. Plümper 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.

7. Conclusion

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. 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 dependence 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 the institutional quality of the sample countries (measured by the democracy index). 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 role of institutional quality in influencing the oil dependence volatility on government expenditure, so this thesis adds new empirical evidences and contributes to literature on oil volatility's effects on the economies of oil exporting countries.

The purpose of this study was to investigate the direct and indirect effect of oil dependence volatility on the aggregated government expenditure in a group of democratic and non-democratic countries. The sample period runs between 1983 and 2016 and a panel Vector Auto-Regressive (PVAR) model, along with panel impulse response functions, are employed. This study evaluated the effect of oil dependence 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.

This difference in response between non-democratic and democratic 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. Therefore, in relation to the pattern of government expenditures in oil exporting countries, the quality of political institutions is important.

Our study has several policy implications. 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. 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 research, 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.

CRediT authorship contribution statement

Azadeh Pazouki: Conceptualization, Data curation, Visualization, Methodology, Software, Validation, Formal analysis, Investigation, Writing – original draft, Resources. **Xiaoxian Zhu:** Supervision, Writing – review & editing.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.eneco.2022.106383.

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