ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 64 36 Number 1, 2016

http://dx.doi.org/10.11118/actaun201664010315

EFFECTS OF OIL PRICE SHOCKS ON THE GHANAIAN ECONOMY

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Abstract

NCHOR DENNIS, KLEPÁČ VÁCLAV, ADAMEC VÁCLAV. 2016. Effects of Oil Price Shocks on the Ghanaian Economy. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 64(1): 315–324.

The economy of Ghana is highly vulnerable to fluctuations in the international price of crude oil. This is due to the fact that oil as a commodity plays a central role in the economic activities of the nation. The objective of this paper is to investigate the dynamic relationship between oil price shocks and macroeconomic variables in the Ghanaian economy. This is achieved through the use of Vector Autoregressive (VAR) and Vector Error Correction (VECM) models. The variables considered in the study include: real oil price, real government expenditure, real industry value added, real imports, inflation and the real effective exchange rate. The study points out the asymmetric effects of oil price shocks; for instance, positive as well as negative oil price shocks on the macroeconomic variables used. The empirical findings of this study suggest that both linear and nonlinear oil price shocks have adverse impact on macroeconomic variables in Ghana. Positive oil price shocks are stronger than negative shocks with respect to government expenditure, inflation and the real effective exchange rate. Industry value added and imports have stronger responses to negative oil price shocks. Positive oil price shocks account for about 30% of fluctuations in government expenditure, 5% of imports, 6% of industry value added, 17% of inflation and 2% of the real effective exchange rate in the long run. Negative oil price shocks account for about 8% of fluctuations in government spending, 20% of imports, 8% of inflation and 2% of the real effective exchange rate in the long run. The data was obtained from the United States Energy Information Administration and the World Bank's World Development Indicators.

Keywords: Ghana, impulse response functions, macroeconomy, oil price shocks

INTRODUCTION

Ghana joined the list of oil producing countries when the country began to produce and export several quantities of the resource on commercial basis in 2010 and beyond. The resource was however discovered in 2007. Before this period, several exploratory activities were undertaken by several multinational oil drilling companies. These activities yielded very little output and could therefore not be classified as production but exploratory.

Major and sustained exploration activity started with the formation of the Ghana National Petroleum Corporation (GNPC) in 1985. GNPC announced a significant discovery of light oil offshore at the Jubilee Field together with partners Tullow Oil and Kosmos Energy in 2007. According to Tullow Oil, it was one of the biggest oil finds in Africa in recent times. The Jubilee field began producing in December 2010, and was estimated to hold 1.5 billion barrels of oil. After producing an average of only 8,880 barrels per day (bpd) in 2010, Ghana's oil production increased to 84,737 bpd by late 2011, with nearly all of that production coming from the Jubilee field according to Ghana Oil Almanac (2013). The country anticipated a rise in total output to 120,000 bpd in 2012 as a result of several new discoveries and improvement in technology.

The economy of Ghana according to the World Bank, grew by 15% in GDP in 2011 which was largely accounted for by increased oil exports (WDI, 2014). The impact on government revenue was enormous. Studies on the role of crude oil prices on the macroeconomies of countries have over the years attracted several volumes of literature with contracdictory results. Researchers such as Hamilton (1983) produced works which established the link between oil price shocks and the national economy of United States of America. His paper observed that oil price shocks were the main contributing factors to the recession. This aroused interest from other researchers who sought to either confirm or otherwise. These included studies from both developed and developing countries' researchers such as (Rasche and Tatom, 1981; Darby, 1982; Hamilton, 1983, 1996, 2003, 2008; Chang and Wong, 2003; Cunado and Gracia, 2005; Kilian, 2008; Lorde *et al.* 2009; Dogrul and Soytas, 2010; Rasmussen and Roitman, 2011) who argued that oil price shocks significantly affect economic activities, mainly economic growth.

Other developing countries' authors who examined the oil-price-macroeconomy relationship include: Papapetrou (2001), Berument and Tasci (2002), Lardic and Mignon (2006) and Zhang (2008). Evidence from their studies suggests that, the degree of negative correlation between oil prices and economic activity strengthens during periods of rapid oil price changes and high oil price change volatility.

Fundamental issues related to this area include questions on whether there is a stable relationship between oil prices and economic growth over time. The second is whether the responses of fluctuations in oil prices and economic activities are symmetric. Studies such as Hooker (1996, 2002), De Gregorio *et al.* (2007) and Kapetanois and Tzavalis (2010) sought to answer the first question. The general conclusion from these studies was that the negative effects of oil price spikes on most important economies have become relatively less important after 1980. The control of energy policy, exploration of alternative energy, and technological advancement in the oil importing industrialized economies were the primary reasons for this observation.

With regards to whether oil price fluctuations have a symmetric relationship with economic activities, several researchers (Mork, 1989; Mork, Olsen and Mysen, 1994; Cunado and Gracia, 2005) observed in their studies that economic activity exhibits asymmetric responds to oil price shocks. In other words, an increase in oil prices tend to depress aggregate economic activity by more than a decrease in oil price.

Hamilton (1996) argued that an increase in oil price will only matter if they are significantly larger in comparison to past experiences since most of the individual price increases are simply corrections to the earlier declines. Lee *et al.* (1995) also worked on the same non-linear measurement dilemma and they opine that variability in oil prices are likely to have greater impact on GDP in an environment of stable oil price movements than in an environment of frequent and erratic oil prices.

Given the high level of dependence of the Ghanaian economy on oil revenues, it is necessary to carry out a comprehensive analysis of the effect of oil price shocks on the economy. This paper is one of the few studies on oil price effects in Ghana.

Chapter 2 focuses on the materials and methods, chapter 3 deals with the results and dicussions, chapter 4 summarizes the conclusions from the study.

In light of the literature presented above, there is a clear absence of nonlinear oil price specification to consider the possibility of asymmetrical response in most of the studies especially, the few on Africa. According to Zhang (2008), accurate estimation of asymmetric and nonlinear oil price shock measure enables a better forecast of the future dynamics of macroeconomic performance. Therefore, our study will step in to provide an asymmetric response transformation and employ a nonlinear estimation in the data series to give further robustness and accuracy to the results. It is an effort to fill the research gap by contributing to the scarce literature on developing oil-importing countries in general and principally on Africa.

The objective of this paper is to investigate the dynamic relationship between oil price shocks and macroeconomic variables in the Ghanaian economy. This is achieved through the use of Vector Autoregressive (VAR) and Vector Error Correction (VECM) models. The variables include: real oil prices, real government expenditure, real industry value added, real imports, inflation and the real effective exchange rate. We approach and partly replicate the research steps in Farzanegan & Markwardt (2009) in the case of VAR and VECM application to the economy of Iran. Our results supply literature with at least one specific contribution. The results then offer more concentration on the impulse response analysis and variance decompositions to get a better grasp about the effects of oil prices on other macroeconomic variables.

MATERIAL AND METHODS

In our analysis, we made use of six macroeconomic variables with yearly observations: real governemnet expenditures (Government), real imports (Import), real effective exchange rate (REER), inflation (Inflation), real industry value added and real oil price. Real government expenditure was used as a variable due to the reliance of government on proceeds from the oil sector (5% of government revenue). The real effective exchange rate was chosen due to the fact that more often that not, increasing oil prices tend to cause the real exchange rate of certain oil exporting countries to appreciate thus leading to contraction of other non-oil tradable sectors. Inflation and imports were added because changing oil prices have inflationary pressures and thus could also influence the level of overal imports. Industry value added was included due to the fact that the oil sector's output is classified under industry. GDP was not included due to the assumption that the effect of oil price changes were conveyed by imports and industry value added.

Government expenditure was measured as the final government consumption expenditure on goods and services in US$. Oil price was measured as the international price of a barrel of crude oil (in US$). Inflation was measured as the average annual percentage change in the price of goods and services measured using the consumer price index. Imports were measured as the total annual amount of imported goods and services in (US$). All variables except inflation were in logarithmic form, inflation was divided by 100. Industry value added was measured as the real output of industry (measured in US$). The real effective Exchange rate and other variables were taken from the World Bank's World Development Indicators. Oil price data was taken from the United States Energy Information Administration.

Previous studies have evidenced that majority of time series data are non-stationary at levels but turn to become integrated (stationary) of order 1 (Engle and Granger, 1987). A stationary time series process is one which has a constant first and second moments and whose probability distribution is stable over time. Stationarity in the data series needed to be ascertained because our estimation technique for the analysis was the restricted Vector Autoregressive model, which assumed that all the variables in the system were stationary using the Augmented Dickey Fuller test (ADF). Therefore, to avoid spurious results and to ensure that the variables fit into the estimation techniques, the study conducted unit root test generally used in the VAR model to examine the stationary properties in the time series data.

The variables were then tested for cointegration and the possible number of cointegrating relationships using the Johansen test of cointegration (see Johansen, 1988). The optimum number of lags was decided using information criteria: Akaike Information Criteria (AIC), Schwartz Information Criteria (BIC) and Hannan-Quinn Criteria (HQC). See (Hannan-Quinn, 1979; Akaike, 1974; Schwartz, 1978).

The condition was that, if the variables were all I(1) they should not theoreticaly be estimated using ordinary VAR model, because there may be one or more equilibrium relationships. We could both estimate how many and what they were (called cointegrating vectors) using Johansen's technique.

If the variables were found to have one or more cointegrating vectors then the suitable estimation technique was a the VECM (Vector Error Correction Model) which adjusts to both short run changes in variables and deviations from equilibrium. That meant that we used VECM model in case of I(1) cointegrated time series. Following the theory and previous empirical studies, we chose between the following three closely related types of models: VAR and VECM. A thorough theoretical exposition of all these models is provided in the monographs of Lutkepohl (2006) and Johansen (1995).

The Models

Given that, $Y_t = (y) = (y_{1t}, y_{2t}, \ldots, y_{nt})'$ denote an $(n \times 1)$ vector of time series variables. The basic p-lag vector autoregressive (VAR(p)) model has the form

$$\Delta Y_t = c + \pi_1 Y_{t-1} + \pi_2 Y_{t-2} + \ldots \pi_p Y_{t-p} + \varepsilon_t + \epsilon_t,$$

$$t = 1, \ldots, T, \quad (1)$$

where c is constant, π_i are $(n \times n)$ coefficient matrices and ϵ_t is an $(n \times 1)$ unobservable zero mean white noise white noise vector process.

Significant relationships from unrelated variables could be obtained when non-stationary time series, are used in a multivariate econometric model. For that, in these cases, we had to by pass unit root test and cointegration through Vector Error Correction Model (VECM). Although the convention in most of the literature, is the use of unrestricted vector autoregression (VAR) model for the oil price-macroeconomy relationship, we decide to apply the restricted VAR or vector error correction model (VECM) for this study. The results were however compared with the results generated using an unrestricted VAR model. The essence of the VECM lies in the implication that the series being studied is cointegrated, thus implying the existence of long-run relationships between the integrated time series. In statistics, the presence of cointegration among relevant variables indicates that a linear combination of nonstationary time series exhibits a stationary series, thus avoiding the problem of spurious regression. An error correction mechanism is incorporated in the model to capture the variations associated with adjustment to a long term equilibrium. For a given time series,

$$\Delta Y_t = \tau Y_{t-1} + \pi_1 Y_{t-1} + \pi_2 Y_{t-2} + \ldots \pi_p Y_{t-p} + \epsilon_t,$$

$$t = 1, \ldots, T. \quad (2)$$

The model VECM(p–1) is derived from VAR(p) and the deciding factor is rank of matrix τ. If rank(τ) = 0 all the I(1) processes are not cointegrated, if rank(τ) = K, all of the processes are I(0) and VAR model is used and if $0 < \text{rank}(\tau) < K$, there exists vectors α and β, that $\tau = \alpha\beta'$, where $\beta' Y_{t-1}$ is cointegrated relationship. VAR models explain the endogenous variables solely by their own history, apart from deterministic regressors.

From the literature, the measurement of oil price shock has proven a contentious issue as different researchers have come up with diverse oil price shock specifications. Indeed, the functional form of the oil price macroeconomy relationship broadly depends on the particular measure of oil price shocks chosen and as generally suggested by Hamilton (2003), an incorrect specification of the functional form has often accounted for the unstable empirical relationship observed between oil price shocks and macroeconomic variables.

According to Mork (1989), Lee *et al.* (1995), and Hamilton (1996), there is a nonlinear oil-price macroeconomy relationship and these authors have proposed different nonlinear specifications of oil price shocks. In this study, we follow the convention by most literature to include both benchmark (linear) and nonlinear specifications of oil price shocks in our analysis.

By linear oil price shock specification, we meant both negative oil price shocks (price increase) and positive oil price shocks (price decrease) were considered together in one analysis. Thus, we did not account for oil shocks separately (see Hamilton, 1996); rather, we only took into consideration the yearly changes in real crude oil price. In order to account for the existence of asymmetrical response where the effects of negative shocks may not be the same as positive shocks, we further specified the nonlinear approach in the analysis (see Mork 1989). Thus, with the non-linear specification we categorized oil price shocks into oil price increase and oil price decrease using the Mork (1989) transformation and investigated their impact separately on economic activity in Ghana. For the purpose of simplicity and want of space, our analysis makes use of these two different oil price shock measurements to ensure robustness of results as possible and also to offer a better explanation into the oil price macroeconomy discussion in Ghana. Linear oil shock can be expressed as in equation (4).

$$dOil_t = \ln Oil_t - \ln Oil_{t-1}. \quad (3)$$

On the other hand nonlinear measure for capturing of price assymetry was expressed as in equaton (5) with regards to real oil price increase.

$$ROILP_t^+ = \max(0,(roilp_t - roilp_{t-1}). \quad (4)$$

Or equation (5) with regards to oil price decrease

$$ROILP_t^- = \min(0,(roilp_t - roilp_{t-1}), \quad (5)$$

where $roil_{pt}$ is the log of real price of oil at time t, $ROILP_t^-$ the real oil price decrease and $ROILP_t^+$ is real oil price increase.

RESULTS AND DISCUSSION

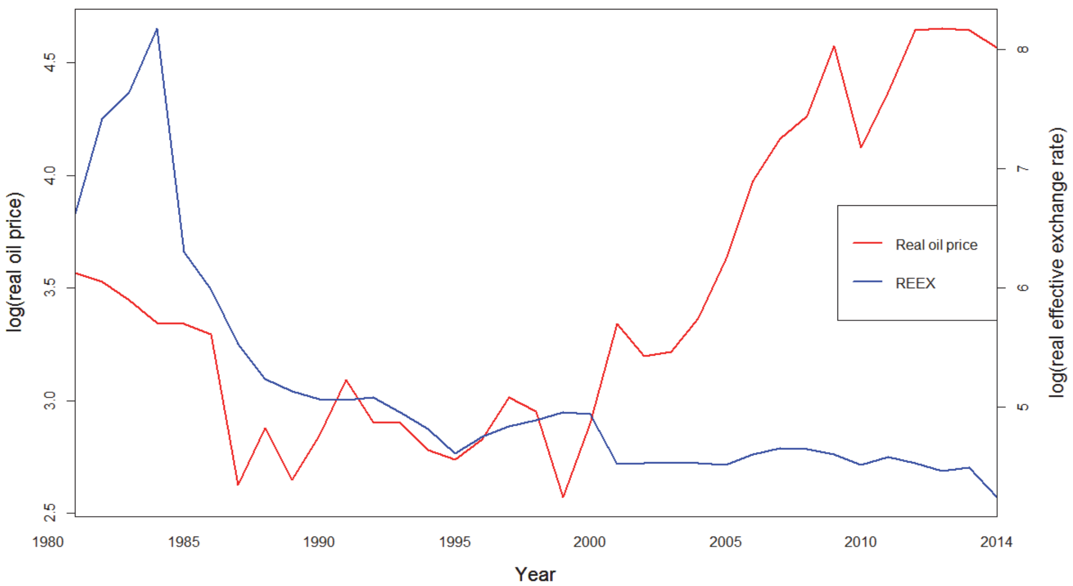
We discussed the results of the model in this section. Fig. 1 compares the movement of the real effective exchange rate and real oil prices in the Ghanaian economy. Both variables were generally declining before the year 2000 but after this period, the real price of oil rises on the average and the real effective exchange rate declines.

Unit Root Test

Stationarity tests using the ADF tests was carried out for each variable, over the sample period 1980 to 2014. We applied models with and without trend. For the log-level series, the ADF test (Dickey and Fuller, 1979) did not reject the null hypothesis of a unit root at 95% confidence level for oil price, government expenditure and industry value added. After first differencing, each series rejected the null hypothesis of nonstationarity at the 99 or 95% levels. Thus, some variables had unit root in levels but were stationary after first differencing. This therefore suggested a possibility of the presence of cointegrating relationship among them.

Maximum Lag Order Selection Criteria

The Johansen cointegration test was carried out to test for cointegrating relationships among real



1: *Co-movement of real oil price and real effective exchange rate*
Source: U.S Energy Information Administration and World Development Indicators

I: *Unit root test*

Variable	Level with trend		First order difference with trend		Critical values		
	Test-statistics	P-values	Test-statistics	P-values	10%	5%	1%
Oil price	–2.03	0.06	–5.11	< 0.01	–3.18	–3.5	–4.15
Government expenditure	–1.05	0.12	–5.40	< 0.01			
Imports	–3.50	< 0.01	–6.78	< 0.01			
Industry value added	–2.34	0.09	–4.22	< 0.01			
Inflation	–3.69	< 0.01	–5.50	< 0.01			
REER	–4.16	< 0.01	–7.11	< 0.01			

II: *VAR Lag order selection*

Lags	loglikelihood	p(LR)	AIC	BIC	HQC
1	2,387.97		156.77	158.72	157.41
2	–2,305.89	< 0.01	153.80	157.41	154.98
3	–2,197.94	< 0.01	149.16	154.43	150.88
4	–2,022.23	< 0.01	140.14*	147.08*	142.41*

Where p represent probability and LR represents Likelihood ratio

III: *Johansen test of cointegration*

Number	Trace test	10%	5%	1%
τ <= 5	2.92	10.50	12.25	16.26
τ <= 4	21.58	22.80	25.32	30.45
τ <= 3	61.59	39.10	42.44	48.45
τ <= 2	107.44	59.10	62.99	70.05
τ <= 1	897.11	83.20	87.31	96.58
τ = 0	NaN	110.00	114.9	124.75

Where τ represents the rank of cointegration

oil prices and the five Ghanian macroeconomic variables. Prior to performing the Johansen cointegration test, variables were entered as levels into a VAR to determine the optimal number of lags needed in the cointegration analysis. Three criteria, Akaike Information Criteria (AIC), Schwartz Information Criteria (SIC) and Hannan-Quinn Criteria (HQC) were applied in addition to the likelihood ratio (LR) test to determine the optimal lag length. From comparison of different models we chose lag of the 4th order (see Tab. II).

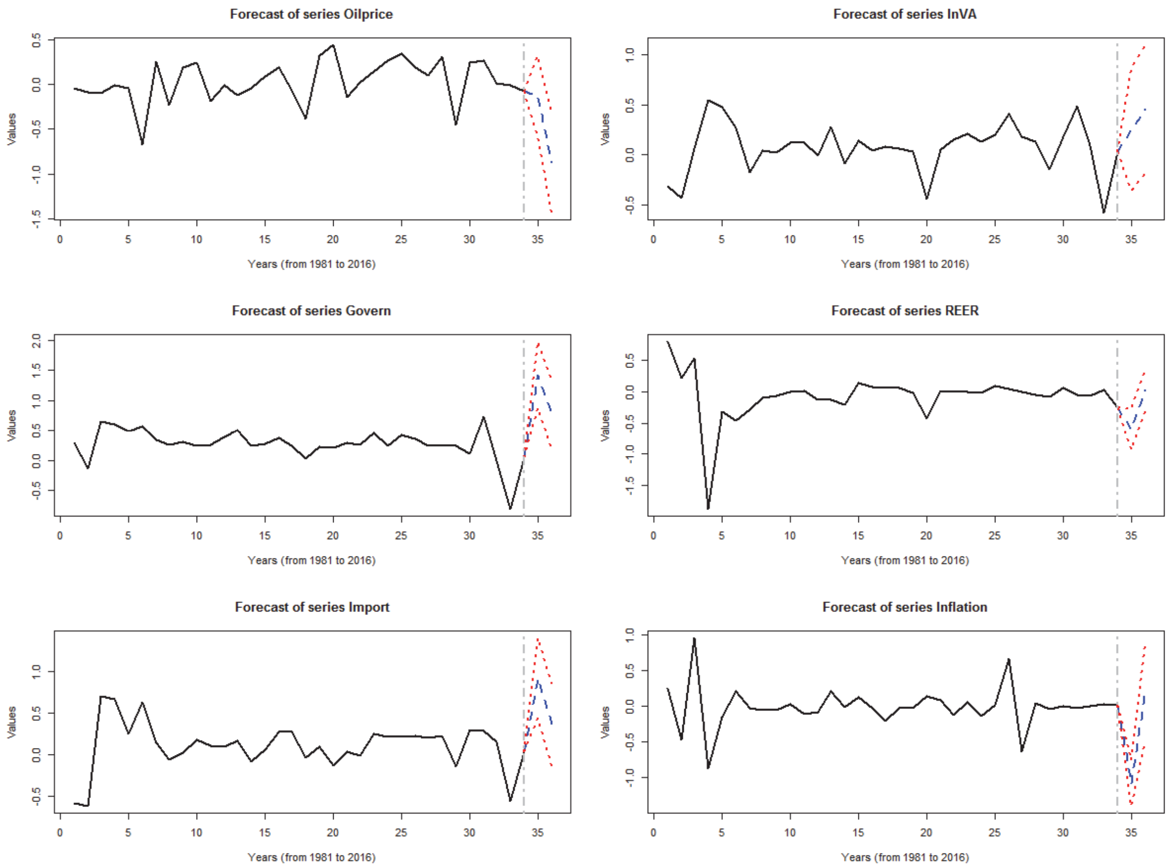
Cointegration Test

Cointegration is a specification of models that include the belief about the movement of variables relative to each other in the long-run. Thus, to investigate the long-run relationship between the variables, the Johansen method of Cointegration was carried out (Johansen, 1988, 1991; Johansen and Julius, 1990). What we sought to find was whether there existed a common stochastic trend in the oil price variable and the macroeconomic variables and we used the maximum likelihood procedure by Johansen to confirm the presence of cointegrating vectors. This method was considered because compared to other cointegrating test methods, the Johansen tests provides more robust estimations. Two tests were proposed under the Johansen method namely, the Trace statistics and the Maximum Eigenvalue statistics but this study used the former. The Trace test statistic for each rank was compared with the 10%, 5% and 1% critical values. A greater Trace test statistic than the critical value indicated a rejection of the null hypothesis of no cointegration. The results (see Tab. III) show that the variables were cointegrated of rank one.

Forecast Series of Variables

Forecasting of variables is presented in Figs. 2 and 3. Fig. 2 shows the results for the VAR model. The results show the forecast for two years in the behaviour of each of the model variables. The forecast predicts a decline in oil prices for the next two years, a rise in the value added of industry, a rise in government expenditure for the first year and a decline in the second, a decline in the real effective exchange rate for the first and second years. Imports are predicted to rise in the first year and decline later marginally. The forecast for inflation is a decline in the first year and a rise which restores it to the current level.

Fig. 3 shows the results of the forecast from the VECM at a 95% confidence level. The forecast for oil prices shows a decline in the first year from the



2: *Two steps ahead forecasting (VAR model, confidence interval 95%)*

current level and a rise in the second year. The trend is similar for industry value added which is predicted to decline and later rise. Government expenditure is shown to rise in the first forecast year and to decline in the second. The real effective exchange rate is predicted to decline and later rise. The forecast show a decline in imports. Inflation declines in the first forecast year and rises beyond the current level in the second year.

Impulse Response Functions (IRFs)

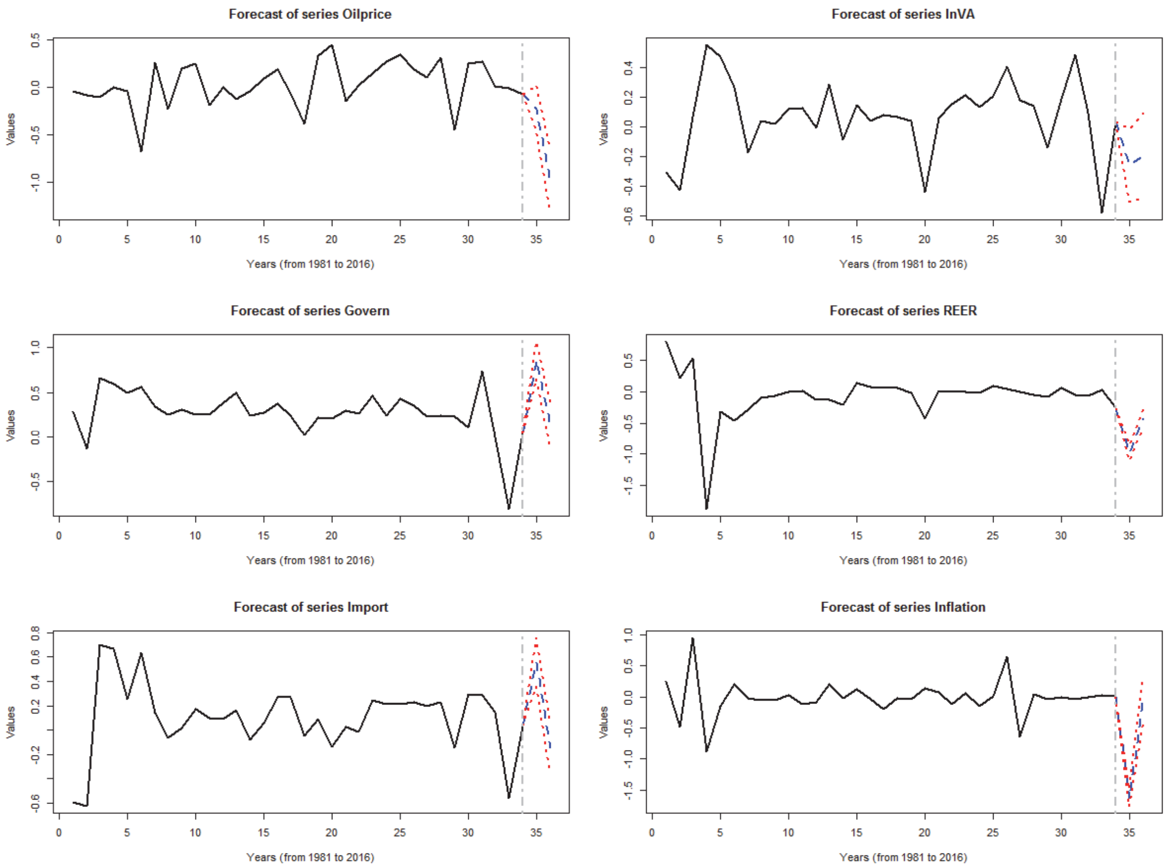
Following the increasing consensus in most literature that oil price shocks has a non-linear relationship with macroeconomic variables, many studies account for asymmetric response possibilities of oil prices on economic activities. By asymmetric response or impact, we mean that the macroeconomic effects of an increase in oil price are not the mirror image of the decrease in oil price. With the benchmark (linear) specification, it is unclear whether oil price shock occurs from decrease or increase in crude oil prices. Consequently, this study followed the method by Mork (1989) nonlinear oil price shocks transformation by categorizing the oil price shocks into negative oil price shocks (when oil price increase or are positive) and positive oil price shocks (when oil price decrease or are negative). Interestingly however, we estimated the negative shocks (oil price increase) and the positive shocks (oil price decrease) because of the positive values for negative shocks and the negative values for positive shocks.

Additionally, the non-linear specification was included to help give further robustness to the results from the benchmark estimation and to provide better explanation to the oil-macroeconomy discussion in Ghana. Figs. 4–6 show IRFs based on one standard deviation shock to positive and negative changes in real oil price for the period of 1980–2014.

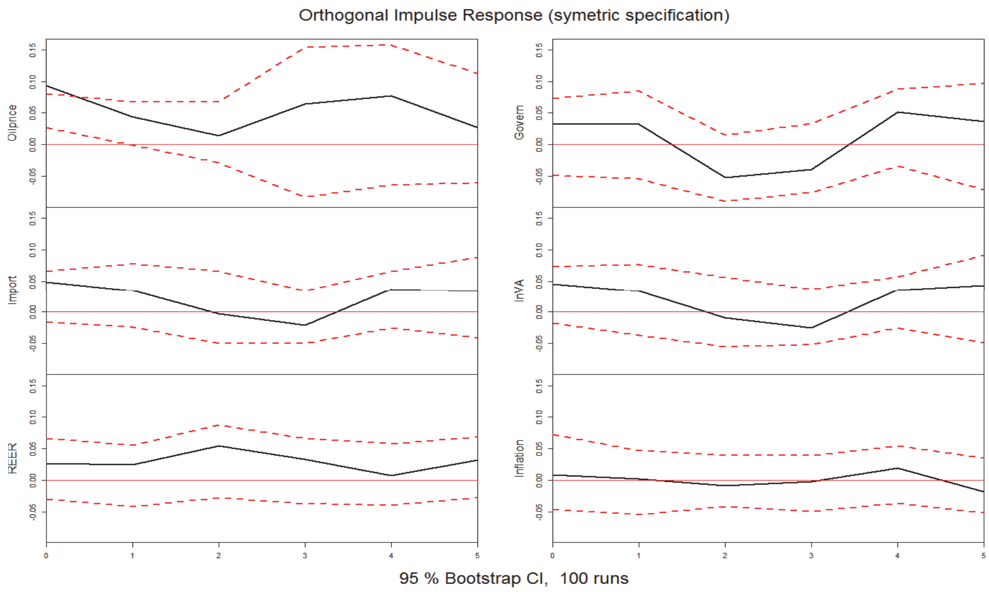
Fig. 4 shows the results for VECM when shocks are assumed to be symmetric. Oil prices slightly increase over time. The pattern of government expenditure, imports and industry value added are similar. The all decrease in the short run and eventually increase in the long run. Inflation decreases over time but the decrease is marginal.

Fig. 5 illustrates the scenario in the cases of assymetric positive oil price shocks in the VECM model. Oil prices decline over time. The same can be said about the rest of the variables though there are more peaks and lows in government expenditure.

Fig. 6 shows the impulse responses in the case of VECM for negative oil price shocks. The decline in oil prices is steady over time. The responses are positive in the long run. The response of government expenditure in the long run is zero. Imports do not respond to negative oil price shocks



3: *Two steps ahead forecasting (VECM model, confidence interval 95%)*

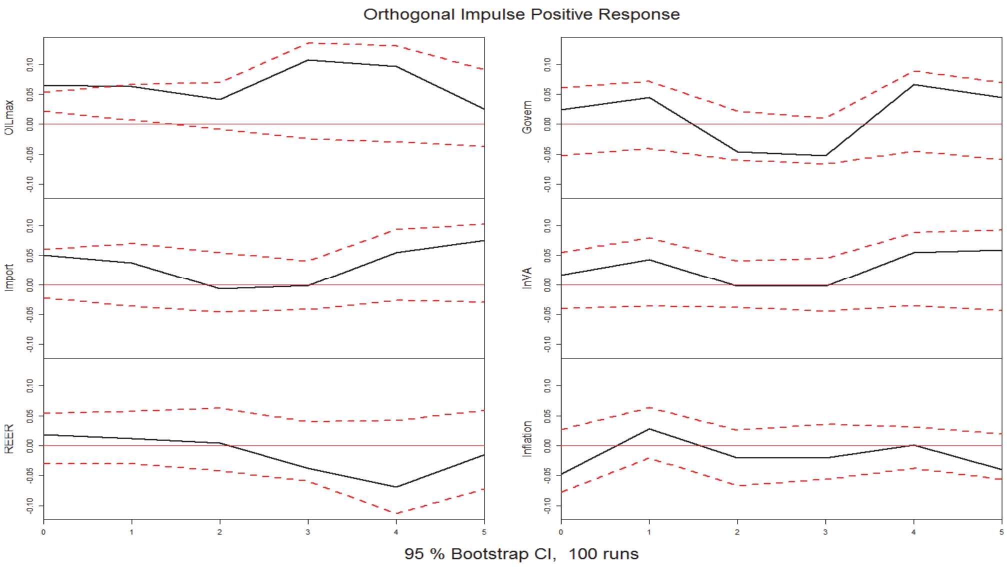


4: *Response to symetric Price Shocks – VECM for 5 periods ahead*

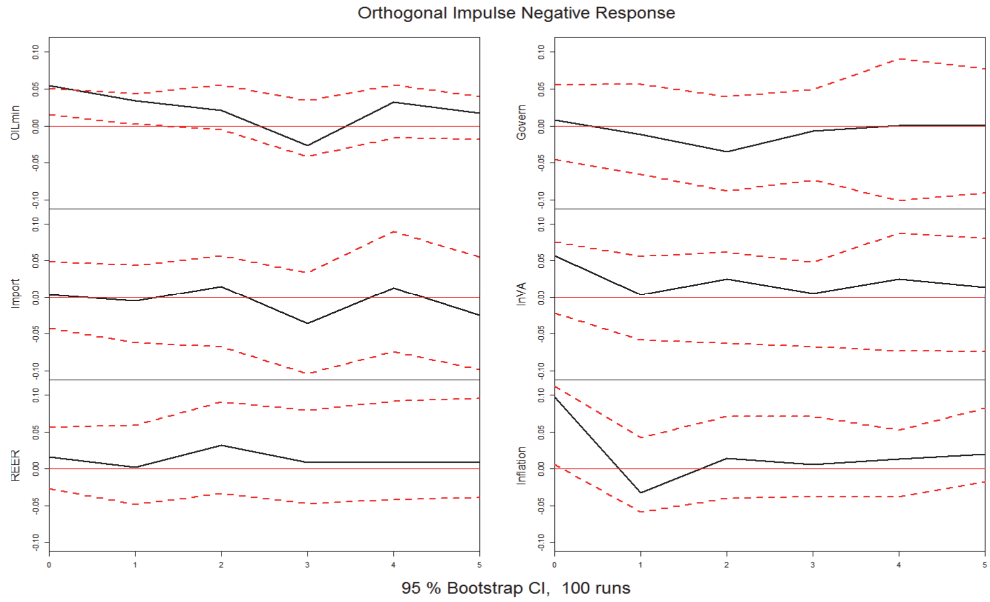
in the short run but have negative responses in the long run. The responses of industry valued added is marginally steady and positive over time. The real effective exchange rate has positive responses in the short run and positive but close to zero (asymptotic) in the long run.

Variance Decomposition of the Series

Tab. IV shows the variance decompositions of the effects of oil price shocks. Positive oil price shocks as can be seen are stronger than the case of negative shocks with respect to government expenditure, inflation and the real effective exchange rate.



5: *Response to positive Price shocks – VECM for 5 periods ahead*



6: *Response to Negative Price Shocks – VECM for 5 years ahead*

IV: *Variance decomposition of ROILP+ and ROILP– (VECM)*

Year	Oil+	Oil–	Gov+	Gov–	Imp+	Imp–	Inva+	Inva–	Inf+	Inf–	REER+	REER–
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.78	0.78	0.00	0.02	0.05	0.00	0.01	0.17	0.16	0.03	0.00	0.00
3	0.62	0.61	0.05	0.04	0.03	0.19	0.04	0.13	0.24	0.03	0.01	0.01
4	0.42	0.55	0.23	0.05	0.03	0.24	0.08	0.10	0.21	0.06	0.02	0.01
5	0.40	0.53	0.30	0.08	0.05	0.20	0.06	0.09	0.17	0.08	0.03	0.02

Where +/– represent the responses to either positive or negative oil price shocks, Gov represent government expenditure, Impr (imports), Inva (Industry value added), Inf (Inflation), REER (real effective exchange rate)

Industry value added and imports have stronger responses to negative oil price shocks. Positive oil price shocks account for about 30% of fluctuations in government expenditure, 5% of imports, 6% of industry value added, 17% of inflation and 2% of the real effective exchange rate in the long run. Negative oil price shocks account for about 8% of fluctuations in government spending, 20% of imports, 8% of inflation and 2% of the real effective exchange rate in the long run.

Comparing the results of this study with others on oil price-macroeconomy relationship from the perspective of developing oil producing countries, Chang and Wong (2003) examine the long term relationship between oil price volatilities and the Singapore macroeconomy using the Johansen Cointegration methodology. Their results reveal that oil price shocks have negative impact on macroeconomic activities in Singapore. Nevertheless, this impact is only marginal. Hooker (1996) postulated that, there exists a diminishing oil price-macroeconomy relationship. In contrast, Jbir and Zouari-Ghorbel (2009) model the recent oil price shock in the Tunisian economy and their findings reveal that oil price shocks do not have any direct impact on economic activities. They argue that the impact of oil price shocks on economic activities is indirect and can be transmitted largely through government spending in the form of subsidy.

Sanchez (2011) analyzed the welfare effects of rising oil prices in oil-importing countries using dynamic Computable General Equilibrium (CGE) model on six oil-importing counties (Bangladesh, El Salvador, Kenya, Nicaragua, Tanzania, and Thailand) for the period 1990–2008. He argues that oil price rise has significant adverse impact on GDP with an average annual GDP loss varying from 0.1% for Tanzania to 20% for Kenya.

CONCLUSION

The main aim of the paper was to investigate the impact of oil price shocks on the economy of Ghana and to assess the impulse response effect on macroeconomic variables using Vector Autoregressive (VAR) and Vector Error Correction (VECM). In other words to identify, with the utilization of quantitative analysis, the nature of relationships between the real oil price development and macroeconomic variables in Ghana such as government expenditure, inflation, imports, industry value added and the real effective exchange rate. The analysis itself was based upon the analysis of time series of individual variables containing yealy data within the period of 1980 to 2014. Quarterly data is usually preferred since oil prices are volatile and change several times within a year but this was not available hence the use of yearly data. The nature of price transmissions was analyzed with the utilization of a vector error correction model and vector autoregression model. The results for the vector error correction model were preferred due to its forecast efficiency.

As Ghana continues to grow into high middle income status with her recent discovery and production of crude oil, the stakes are quite high that in the near future the country could wean herself off the high crude product importation. Nonetheless, Ghana is still a developing net-oil exporting economy with heavy dependence on energy. The verification of the relationship between oil price shocks and macroeconomic variables seems very essential for most policy implications and investment decisions. There is a large amount of literature on the effects of oil shocks on developed economies which have largely driven theoretical suggestions about the oil price-macroeconomy relationship. Formal study on the impact of oil price fluctuations on Ghana as well as most developing oil importing economies seems to be lacking especially from Africa. This study departs from other papers in focusing on the impacts of oil shocks on the macroeconomy of a developing net oil exporter in the case of Ghana, thereby providing a fresh perspective into the oil-macroeconomy relationship. Applying the Johansen cointegration methodology as an empirical modeling, we examine the long-term relationship between the oil price shocks and the macroeconomy of Ghana.

Following the results from the Johansen's cointegration testing, we applied the VECM as estimation technique for the oil price-macroeconomy relationship. As per a common notion among many researchers in the literature, the nonlinear relationship is more appropriate for capturing the oil-macroeconomy relationship hence, we specified the benchmark (linear) oil price shocks and nonlinear oil price shocks. The empirical findings of this study suggest that both the linear and nonlinear oil price shocks have adverse impact on the macroeconomic variables in Ghana. This confirms what economic theory suggests given the fact that Ghana is highly an oil dependent economy. This is evidenced in the report by the Institute of Statistical, Social and Economic Research (ISSER, 2013) that, Ghana's oil export accounts for around 22% of her total merchandise export, and 5% of government revenue. It is therefore realistic to expect some level of impact from oil price shocks.

While we acknowledge diverse results and conclusions from other studies, there is also a clear and convincing evidence that oil price shocks pose detrimental effect to the economic activities of most oil importing and exporting developing economies like Ghana. From the literature review, it could be observed that relatively very little work is done when it comes to the contribution from oil-importing developing countries in Africa on this topic despite the continent's high dependency on oil.

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