

Journal of Economics and International Finance

Volume 8 Number 10 December 2016

ISSN 2006-9812



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The **Journal of Economics and International Finance (JEIF)** is published monthly (one volume per year) by Academic Journals.

Journal of Economics and International Finance (JEIF) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as econometrics, trade balance, Mercantilism, Perfect competition etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JEIF are peer-reviewed.

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Full Length Research Paper

Can Cameroon become an emerging economy by the year 2035? Projections from univariate time series analysis

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Received 12 August, 2016; Accepted 19 September, 2016

Cameroon is among the African countries aspiring to become an emerging economy by the year 2035. Therefore, projecting into the future by policy makers in order to know the right course of action is imperative. The objective of this study is to identify a good forecasting model that can predict Cameroon's future economic growth rate and to ascertain whether policy makers could maintain a steady and sustainable growth rate that will fructify its vision of becoming an emerging economy by 2035. The study employed ARIMA and ARIMA/GARCH models on quarterly data from 1994q1 to 2014q4 on economic growth rate extracted from World Bank Development Indicators. Among the different models used, the mixed ARIMA(0,1,3)/E-GARCH(1,2) model was selected on the basis of the root mean squared error (RMSE), mean absolute percentage error (MAPE), mean absolute error (MAE) and the Theil's inequality coefficient (U-STATISTICS) criteria. The major finding of this study is that Cameroon's future growth rate is slow and not sustainable with an average annual projected growth of approximately 6.099 %, unlike China that maintained a steady growth rate till it transcended into an emerging economy. The projected rate compared to China's growth rates, shows that Cameroon needs to double her efforts in order to fructify its vision of becoming an emerging economy by the year 2035.

Key words: Emerging economy, economic growth rate, ARIMA/GARCH models.

INTRODUCTION

Most African countries want to become key decision makers in the world's economic arena by swinging their economic pendulum towards an emerging economy. In this light, careful planning, strategies and transformation agenda that will diversify their economies, improve private sector development, and above all increase the rate of competitiveness are gradually being implemented.

Therefore, warning signals on the behaviour of future macroeconomic variables are necessary for policy makers to plan, strategize and take necessary measures ahead of time in order to circumvent economic downturns and brighten opportunities for sustained development. Cameroon is one among the many visionary African countries that wants to impose her position in the top 20

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JEL: E24, C22, C53

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leading economies of the world by the year 2035. To fructify its vision, the government has prioritized five areas of development: (i) infrastructure development in energy; (ii) telecoms and transport; (iii) development of the rural and mining sectors; (iv) improvement in human resources through health, education, and training; (v) greater regional integration and export diversification; and financial sector deepening and strengthening (Cameroon, 2009). It is expected that all these will be achievable through a robust industrialization strategy, greater national integration and the advancement of democracy, private-sector promotion strategy, good governance and management strategy with blueprint for a resource allocation strategy, a strategy for sub- regional and international integration, a strategy for partnership and development assistance, and a development funding strategy (Cameroon, 2009).

However, the aspirations of becoming an emerging economy seem to be fading gradually, simply because the government does not want to relinquish its centrally planned economic structure to a decentralized system that fully integrates the private sector. The emergence of China began with a transition from a centrally planned economy to a socialist market economy initiated by the then Vice Premier of China Deng Xiaoping (Barth et al., 2009). Also, the country is saddled with a high rate of corruption, severe insurgency that is diverting attention and resources and a despondent democratic society. Freedom House Assessment (2014) shows that the regime is authoritarian and restrains the political rights and civil liberty of its citizens (Freedom House, 2014).

Though Cameroon's growth indicator exhibited a positive upward trend within the last five years, that is, approximately 3.27, 4.14, 4.49, 5.56 and 5.89% in 2010, 2011, 2012, 2013 and 2014 respectively (World Development Index, 2015), the process is still very slow and not promising. World Bank Development Index (2015) shows that China grew at an approximate rate of 7.81, 8.17, 9.02, 10.75% and 15.21% in 1980, 1981, 1982, 1983 and 1984 respectively just immediately after the transition process was initiated in 1979.

However, since the government is determined and is effortlessly strategizing towards an emerging economy by the year 2035 despite its socio-politico economic upheavals, it needs to gauge the tempo of its future economic growth. Projecting into the future will give a clearer picture of how the state of the economy is likely to perform and also inform policy makers on whether they are progressing or not and how they need to fine-tune their efforts, the quantum of resources to be mobilized and allocated efficiently and whether they can sustain a steady and increasing economic growth that will guarantee the country's emergence by the year 2035.

Therefore, the rationale for this study is to identify a forecasting model that can project Cameroon's future growth rates that will eventually guide policy makers to carefully strategise ahead of time, thereby, fructifying its

vision of an emerging Cameroon in 2035.

THEORETICAL/EMPIRICAL LITERATURE

Theoretical literature

Historical patterns in time series data can be generated with the use of forecasting models predicated on mathematical formulae. Time series data by their nature, display a pattern such that their successive observations are dependent or correlated. The principal aim of modelling is to capture this underlying phenomenon using the observed time series in order to predict the likely realization of future values (Nkwatoh, 2012).

Early traditional forecasting models range from; the Naïve model to the Moving Averages and Exponential Smoothing models and to the Holt's and Winter's models. Nasir et al. (2008) note that though the applicability of the naïve method is simple and can be used for relatively short time series, yet the model is highly sensitive to changes in actual values such that a sudden drop or sharp increase in the series will affect the forecast. Furthermore, fitting this model type will result in the loss of the first two observations in the series, just like the moving averages method which gives equal weighting to each and every observation, with the average value being over dominated by extreme values (Yule, 1926; Pardhan, 2012). The major advantage of the exponential smoothing method among others is that, it embodies the advantages of weighted moving averages since current observations are assigned larger weights and also, it reacts more quickly to changes in data patterns than the moving averages (Pardhan, 2012). However, the main difficulty encountered when using this method resides in the determination of the size of a smoothing coefficient (α) (Nasir et al., 2008).

The Holt's method is highly adaptable for data with small local trend with no seasonal patterns while the Winter's method suitably works for data that has both seasonal and a trend factor alongside a random pattern (see, Eviews-2). However, it poses the same problem of choosing α just like with exponential smoothing.

In recent years, forecasters have applied alternative approaches (Multiple Regression Models and the Box-Jenkins' Autoregressive Integrated Moving Average (ARIMA) Model) to forecast future values, owing to the fact that the traditional methods of forecasting are generally rigorous and time consuming, and also they require a laborious iterative approach.

The regression method has appeared in contemporary motivating literature: (Syariza and Noorhafiza, 2005; Taylor, 2008; Javadadi and Suhartono, 2010) etc. However, the major setback of the regression approach reposes on the severity of its underlying assumptions, thereby paving way for the Box-Jenkins methodology being extensively used in recent times (Floros, 2005;

Kamil, and Noor, 2006; Purna, 2012) etc. Two important assumptions of regression analysis that pose a threat to model building and forecasting are: independence of residuals (*No Autocorrelation*) and constant variance of residuals (*Homoscedasticity*). Violation of these two assumptions may make the regression estimates meaningless (Nanda, 1988; Greene, 2003; Bourbonnais, 2004 and Gujarati, 2004). Another key assumption of regression analysis is the independence of explanatory variables (*Multicollinearity*) and its violation which leads to a singular matrix (*Determinant Equals to Zero*) thus, making it impossible to obtain regression estimates.

For the sake of forecasting, the Box-Jenkins' method is considered to be superior as it directly takes into consideration the problem of autocorrelation (Nanda, 1988). Yule (1926) first introduced the autoregressive (AR) models, which was later complemented in 1937 by Slutsky with the introduction of Moving Averages (MA) models. Wold (1938) combined the two mathematical models commonly referred to as the ARMA model (*Autoregressive Moving Average*). He showed that ARMA processes could be used to model any stationary time series as long as the appropriate number of AR terms (p), and the appropriate number of MA terms (q), was correctly specified. This implies that any series (y_t) can be modelled as a linear combination of its previous time value and a finite number of its past errors. That is:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \dots + \phi_p y_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \dots - \theta_q \varepsilon_{t-q} \dots \dots \dots \quad (1)$$

However, ARMA models could not be applied to real series until the mid 1960s when computing technology became available and economical (Makridakis and Hison, 1979). The use of ARMA models was made popular by Georg Box and Gvily Jenkins (1970), with the provision of guidelines for making the series stationary in both its mean and variance¹. Makridakis and Hison (1979) also suggest the use of the coefficients of the sample autocorrelation functions (ACF) and partial autocorrelation functions (PACF) for determining appropriate order of p and q (Nanda, 1988; Greene, 2003; Bourbonnais, 2004; Gujarati, 2004). Their approach to modelling ARIMA models otherwise known as the Box-Jenkins methodology has become highly applicable in recent times. The applicability of this methodology has permeated other areas of science chiefly because of the development of new statistical procedures accompanied by more powerful computers that can manage larger data sets with ease. The integrated component (I), gives the model leverage over non-stationary time series. This methodology is found in the empirical works of (Cooper, 1972; Nelson, 1972; Elliot, 1973), among others (Narasimham et al., 1974; McWhorter, 1975) etc and recently in the 2000s (Proietti, 2001; Mandal, 2005; Ghosh, 2008; Pei, 2008;

Wankhade et al., 2010; Ahmad and Latif, 2011; Lee et al, 2012) etc.

Just like other forecasting methods, the short comings of the Box-Jenkins' methodology are not farfetched. First, the interpretation of the autocorrelation functions (ACF and PACF)² is sometimes difficult and requires a lot of expertise. Second, ARIMA models are susceptible to outliers leading to false results. However, Javendani and Suhartono (2010) showed that, the exponential smoothing method can suitably replace the ARIMA model in this case, because it gives more weight to the most recent observation.

Empirical Literature

Modelling macroeconomic variables and projecting into the future, with the use of historical data from time series (univariate or multivariate time series) is not only a fascinating and academic exercise but also, it gives a bearing to policy makers' decision making-process. Modelling economic growth like any other macroeconomic variable has either been analyzed using the traditional moving averages method or the use of econometric models, often related to stationary time series, ranging from the simple ordinary least square technique, to the Autoregressive Integrated Moving Average (ARIMA) models and to the Generalised Autoregressive Conditional Heteroscedastic (GARCH) models (Elham, 2010; Assis et al., 2010).

Recently, the Box and Jenkins methodology has been extensively used, to project future macroeconomic variables including economic growth.

However, other econometric techniques have been used other than the ARIMA models proposed by Box and Jenkins. For instance, Gan and Wang (1993) used the Base Bayesian Vector Autoregressive (BVAR) model to project the economic growth of Singapore. Abeyasinghe (1998) employed an exponential nonlinear approach to predict Singapore's seasonal GDP. Hukkinen and Viren (1999) used a model based on the Keynesian theory to project 50 macroeconomic variables for Finland. Similarly, Jaafar (2006) and Nasir et al. (2008) have used methods other than ARIMA models. Other econometric models have proven their predictive power over ARIMA models.

Baffigi, Golinelli and Parigi (2004), predicted the growth rate of GDP in Germany, France, Italy and Europe region using the Bridge Model (BM) and other basic models such as ARMA, VAR and a structural model. They concluded that the Bridge Model (BM) outperformed all

²SACF and PACF can be used to determine order of stationarity of a time series. If the SACF of the time series values either cuts off or dies down fairly quickly, then the time series values should be considered stationary. On the other hand, if the SACF of the time series values either cuts off or dies down extremely slowly, then it should be considered non-stationary. Bowerman, O'Connell, and Koehler, 2005)

¹The constant mean and variance can be obtainable by removing the pattern caused by the time dependent autocorrelation.

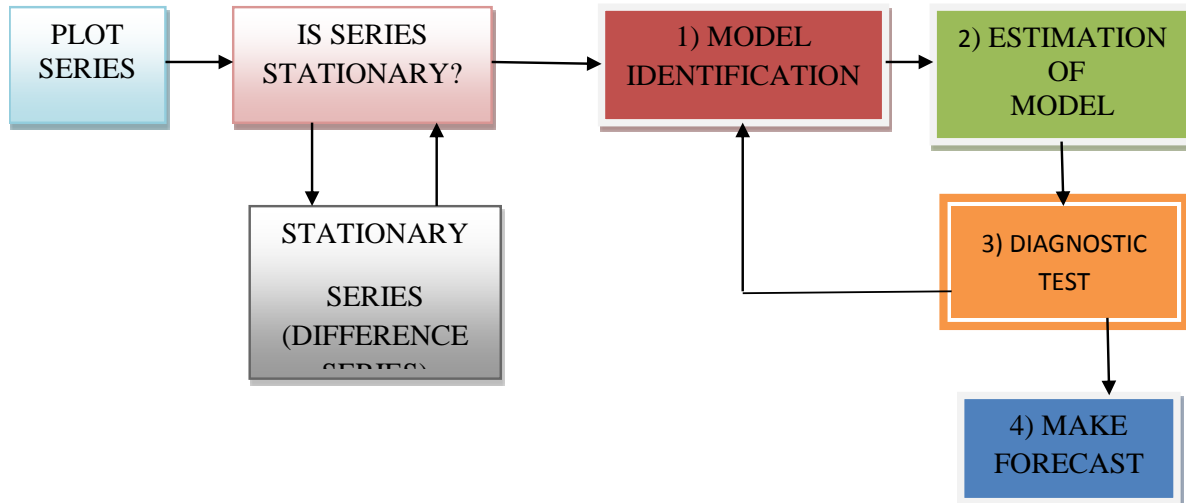


Figure 1. Box-Jenkins methodology.

other techniques used in their study. A more recent submission by Sarbijan (2014) shows that the Markov switching model could better forecast Iran's economic growth than ARIMA models. Gil-Alana (2001) showed that a Bloomfield exponential spectral model gave a feasible result, in lieu of ARMA models, for UK's unemployment rate while, Golan and Perloff (2002) concluded that nonparametric methods of forecasting unemployment rates in the U.S outperformed other models.

Many studies have focused entirely on the ARIMA models to predict macroeconomic variables. Maity and Chatterjee (2012) showed that a simple tentative ARIMA (1, 2, 2) model was well fitted for projecting Indian's GDP growth rates. Similarly, Reynolds et al. (1995) and Reilly (1980) have also projected economic growth rates using ARIMA models.

The choice of the ARIMA models for forecasting other macroeconomic variables other than GDP can also be found in studies: Purna (2012) forecasting cement production output in India; Mordi et al. (2006) analyzing inflation rates in Nigeria; Fatimah and Roslan (1998) forecasting cocoa prices in Malaysia, Nkwatoh (2012) forecasting unemployment rates for Nigeria etc. Notably, Assis et al. (2010) observed that the research costs of ARIMA models is relatively low compared to other econometric models, and relatively more efficient in short term forecasting.

Recently, studies have captured the heteroskedastic property of time series by incorporating the Autoregressive Conditional Heteroscedastic (ARCH) model introduced by Engle (1982). However, the Generalized Autoregressive Conditional Heteroscedastic (GARCH) models have provided more parsimonious results than ARCH models. This is similar to situations where ARMA models have perform better than simple AR models

(Assis et al., 2010).

Floros (2005) compared the out-of-sample forecast accuracy for the United Kingdom unemployment rate and established that, though an MA(4) model performed well, the MA(4)-ARCH (1) model provided superior forecasts. Zhou et al. (2006) showed that the ARIMA/GARCH model outperformed the Fractional Autoregressive Integrated Moving Average (FARIMA)³ for predicting telecommunication network. Assis et al (2010) have also demonstrated the superiority of the mixed ARIMA/GARCH model over the exponential smoothing, ARIMA, and GARCH models in forecasting future prices of cocoa beans in Malaysia. Similarly, Kamil and Noor (2006) concluded that the mix ARIMA/GARCH model outperformed the Autoregressive Conditional Heteroskedasticity (ARCH) model when used to forecast the price of raw palm oil in Malaysia (Figure 1).

METHODOLOGY/FORECASTING MODELS

This work used GDP growth rates data from 1994 to 2015 obtained from World Bank Development Indicators Website 2015. The initial data was annual but later transformed into quarterly data using Eviews software. The rationale for splitting the data is because short term forecast is better than long term forecast. The starting date 1994 is considered because it is the period immediately after devaluation when Cameroon's growth rate assumed a continuous positive value. This study employed ARMA, and the mixed ARIMA/GARCH models with aim of identifying the best model suitable for predicting future growth rates for Cameroon.

ARIMA Models

The analysis of ARIMA models follows the Box-Jenkins methodology

³ For Fractional Autoregressive Integrated Moving Average model,(see, Green 2004, 647-648).

that combines both the moving average (MA) and the autoregressive (AR) models. Initially, these models were analyzed by Yule-Walker. However, a systematic approach that synchronizes both approaches for identifying, estimating and forecasting the models was advanced by Box and Jenkins (1970). The Box-Jenkins methodology begins with an ARMA (p,q) model which combines both the AR and MA models as follows:

$$Y_t = \gamma x_t + e_t \dots \dots \dots (2)$$

$$e_t = \sum_{i=1}^p \alpha_i y_{t-i} + \sum_{j=1}^q \beta_j \varepsilon_{t-j} + \mu_t \dots \dots \dots (3)$$

Where, x_t represents the explanatory variables, e_t is the disturbance term. In equation (3), (y_{t-i}) are AR terms of order p, ε_{t-j} are MA terms of order q and μ_t is a white-noise innovation term. In case of a non-stationary data, the series is differenced (integrated) such: $\Delta^d Y_t = (1 - B)^d y_t$, (d is the number of times a series is differenced to become stationary; l=d) then the ARMA (p,q) model becomes ARIMA(p,d,q) models (Auto- regressive Integrated Moving Average of order p,q).

Conceptual Framework for the Box-Jenkins Methodology

The process of Box-Jenkins ARIMA modeling requires four major steps: identification, estimation, diagnostic checking and forecasting.

1) The identification process starts by testing for the stationary properties of the series. This is done by analyzing the correlogram of the time series or carrying out a unit root test (Augmented Dickey Fuller Test and Phillips Perron test)⁴. After testing the stationary properties, it is essential to find the order of the ARIMA process. An autoregressive process AR (p) model has partial autocorrelations (PACF) that truncates at lag 'p' while its autocorrelation functions (ACF) dies off smoothly at a geometric rate. A moving average process MA (q) has an ACF that is truncated at lag 'q', while its partial autocorrelations (PACF) declines geometrically.

Alternative model selection criteria such as Akaike Information Criteria, Schwarz Bayesian Criteria⁵, Adjusted R², and Final Prediction Error can be used to verify the order (p,q).

2) After determining the order of p and q the specified regression model is estimated which entails a nonlinear iterative process of the parameters α_i and β_j . An optimization criterion like least error of sum of squares, maximum likelihood or maximum entropy is used. An initial estimate is usually used. Each iteration, is expected to be an improvement of the last one until the estimate converges to an optimal one (Etuk et al., 2012).

⁴ADF test: $\Delta X_t = a + bt + \rho X_{t-1} + \sum_{i=1}^k \Delta X_{t-i} + \mu_t$; ΔX_t is the first difference of the series X, k is the lag order, t is the time.

PP test: $\Delta X_t = a + bX_{t-1} + c(t + \frac{T}{2}) + \mu_t$; a, b, and c are the coefficients and T is the total number of observations. Therefore, the ADF and PP unit root tests posit a null hypothesis $\beta = 0$ versus an alternative hypothesis $\beta < 0$, where the ADF and PP statistics is compared with the observed Mackinnon critical values.

⁵ $AIC(p + d + q) = \ln \sigma_{p+d+q}^2 + 2(p + d + q)$ and $SIC(p + d + q) = \ln \sigma_{p+d+q}^2 + \frac{2(p + d + q)}{n}$

σ^2 is the maximum likelihood estimate of the residual variance when the model has k parameters. The optimum model corresponds to the minimum of the criteria within the explored range.

3) The fitted model is tested for goodness-of-fit. It can be tested using the above mentioned model selection criteria. Alternatively, the ACF and PACF obtained from the residual of the specified ARIMA model as well as the χ^2 and Ljung-Box Q statistics are diagnostic checking tools. If the residual is free from all classical assumption of the regression model and stationary then the model is correct (Purna, 2012).

4) The estimated ARIMA model is used to recursively forecast periods ahead.

Consider the general ARMA model:

$$y_t = a + \varphi_1 y_{t-1} + \dots + \varphi_p y_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \dots + \theta_q \dots \dots \dots (4)$$

Then the forecasted ARIMA model:

$$\hat{y}_{t+1} = \hat{\varphi}_1 y_t + \hat{\varphi}_2 y_{t-1} + \hat{\theta}_1 \varepsilon_t + \hat{\theta}_2 \varepsilon_{t-1} + \hat{\delta} \dots \dots \dots (5)$$

Where a, is the intercept term, φ_i are the parameters of the autoregressive process, θ_j are the parameters of moving average process.

ARCH/GARCH Model

The Autoregressive Conditional Heteroscedastic (ARCH) model was formulated by (Engle, 1982) and extended to the Generalised Autoregressive Conditional Heteroscedastic (GARCH) model by Bollerslev (1986). This approach requires a joint estimation of the mean and variance equations. The current conditional variance a time series depends on the past squared residuals of the process and on the past conditional variances.

A univariate regression with GARCH (p,q) effects in a polynomial form with a lag operator is represent as:

Mean Equation:

$$y_t = x_t \gamma + \varepsilon_t \dots \dots \dots (6)$$

$$\varepsilon_t | \Omega_{t-1} \sim N(0, \delta_t^2) \text{ and } \varepsilon_t = v_t \sqrt{\sigma_t^2}$$

Variance Equation:

$$\sigma_t^2 = \sigma + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^p \beta_j \sigma_{t-j}^2 \dots \dots \dots (7)$$

Where, p is the order of GARCH term and q is the order of ARCH term.

Whereas y_t is the endogenous variable and x_t exogenous, Ω_{t-1} is all collected messages up to t-1 period, and δ_t^2 is conditional variance which depends linearly on past squared-error terms and past variances. $\gamma_i \geq 0, \varphi_i \geq 0, \forall i$ are parameters to be estimated. $\alpha_i + \beta_i \leq 1$.

ARIMA/GARCH

A combination of the ARIMA (p,d,q) and the GARCH(p,q) are expressed as:

$$(\Delta y_t)^d = \sum_{i=1}^p \rho_i (\Delta y_{t-1})^d + \varepsilon_t + \sum_{j=1}^q \varphi_i \varepsilon_{t-j} \dots \dots \dots (8)$$

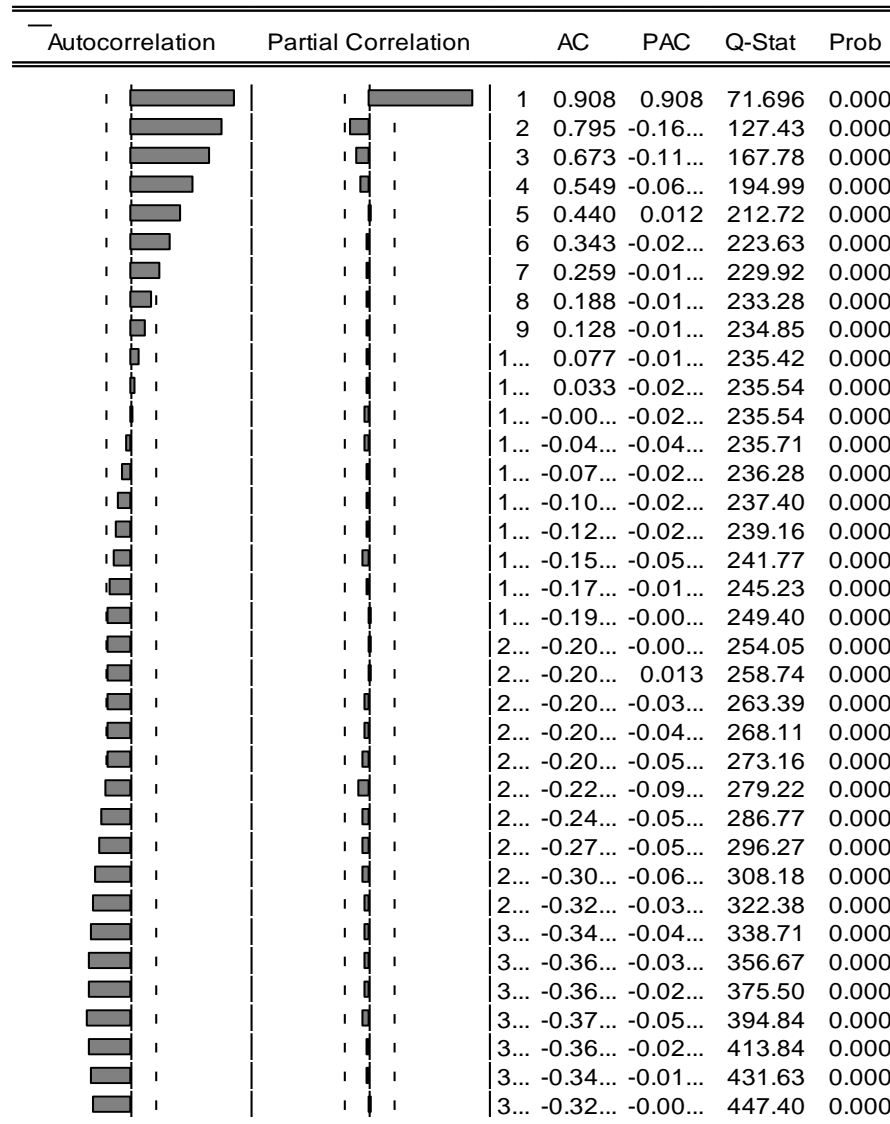


Figure 3. Correlogram of GDP growth rate series. Source: Eviews 9 Output.

Table 1. Quarterly seasonal coefficients.

Scaling factor	
1	0.999556
2	0.999051
3	1.000360
4	1.001034

Original series: GDP; Adjusted Series: GDPSA.

DGDPSA series. Only the first three spikes of the simple autocorrelation function (SACF) are significantly different from zero because they extend outside the band confidence interval while the remaining spikes die down slowly with the band up to the last lag. The spikes of

partial autocorrelation function (PACF) follow a sinusoidal pattern within the first nine lags and dies down slowly within the band confidence interval. It implies the anticipated model that can be used to project Cameroon's growth rate is a moving average model of order three

Table 2. Augmented Dickey–Fuller and Phillips-Perrons Tests for GDPSA at Levels (Eviews 9 Output)..

Null hypothesis: GDPSA has unit root		t-Statistic	Probability value
Augmented Dickey-Fuller test statistic		-1.243662	0.2980
Test critical values:	1% level	-4.072415	-
	5% level	-3.464865	-
	10% level	-3.158974	-
Phillips-Perron test statistics		-2.563179	0.0884
Test critical values:	1% level	-4.072415	-
	5% level	-3.464865	-
	10% level	-3.158974	-

Source: Eviews 9 Output

Table 3. Augmented Dickey–Fuller and Phillips-Perrons Tests for GDPSA at First Difference (Eviews 9 Output).

Null hypothesis: GDPSA has unit root		t-Statistic	Probability value
Augmented Dickey-Fuller test statistic		-3.50809	0.2980
Test critical values	1% level	-4.086877	-
	5% level	-3.471693	-
	10% level	-3.162948	-
Phillips-Perron test statistics		-4.239618	0.0061
Test critical values	1% level	-4.073859	-
	5% level	-3.465548	-
	10% level	-3.159372	-

[MA (3)]. Table 4 shows the estimated result of ARMA (0, 1, 3) inconformity with $p + q \leq 5$ criteria. The values of DW and R^2 are good and the values of the Akaike and Schwarz criteria are small. Also, all the coefficients of the model are statistical different from zero. Conclusively, the model is well fitted and can be used for projections. The correlogram in Figure 5 shows that none of the spikes extends out of the intervals and also, the Q-statistic has a critical probability value closer to 1 as we move downwards to the last lag. Thus, the residuals can be assimilated to a white noise.

However, the series exhibits a heteroskedastic property because the ARCH (1) test has a probably value of 0.000102 smaller than 0.05. Thus, to make the model void of heteroskedasticity, the series is modelled as ARIMA/ARCH or GARCH process.

Tables 5 and 6 show the results of the estimated ARIMA(0,1,3)/GARCH(1,2) and ARIMA(0,1,3)/E-GARCH (1,2) model. The models are more robust than the previous estimated ARIMA(0,1,3) model because the probability values of the ARCH tests are 0.99 and 0.104

greater than 0.05. Also, all the ARCH and GARCH effects are significant. Hence, Cameroon's growth rate can be forecasted using an ARIMA/GARCH mix model (Table 8).

Model selection criteria

The Root mean squared error (RMSE), mean absolute percentage error (MAPE), mean absolute error (MAE) and Theil's inequality coefficient (U-Statistics)⁷ were used to determine the best forecasting model: The table below shows that, ARIMA(0,1,3)/E-GARCH (1,2) is the best

$$\begin{aligned}
 &^7 1. \quad RMS = \sqrt{\frac{ESS}{n}} \quad 2. \quad MAE = \sum_{t=1}^n |Y_t - \hat{Y}_t| \quad 3. \\
 &MAPE = \frac{\sum_{t=1}^n \frac{|Y_t - \hat{Y}_t|}{Y_t}}{n} \times 100\% \\
 &4. U - Statistics = \frac{RMSE}{\sqrt{\frac{\sum_{t=1}^n \hat{Y}_t^2 / n}{\sum_{t=1}^n Y_t^2 / n}}}
 \end{aligned}$$

NB: Y_t = The actual value at time t ; \hat{Y}_t = The forecast value at time t ;
 n = The number of observations; ESS = The error sum of square.

Sample: 1994:1 2014:4
 Included observations: 83

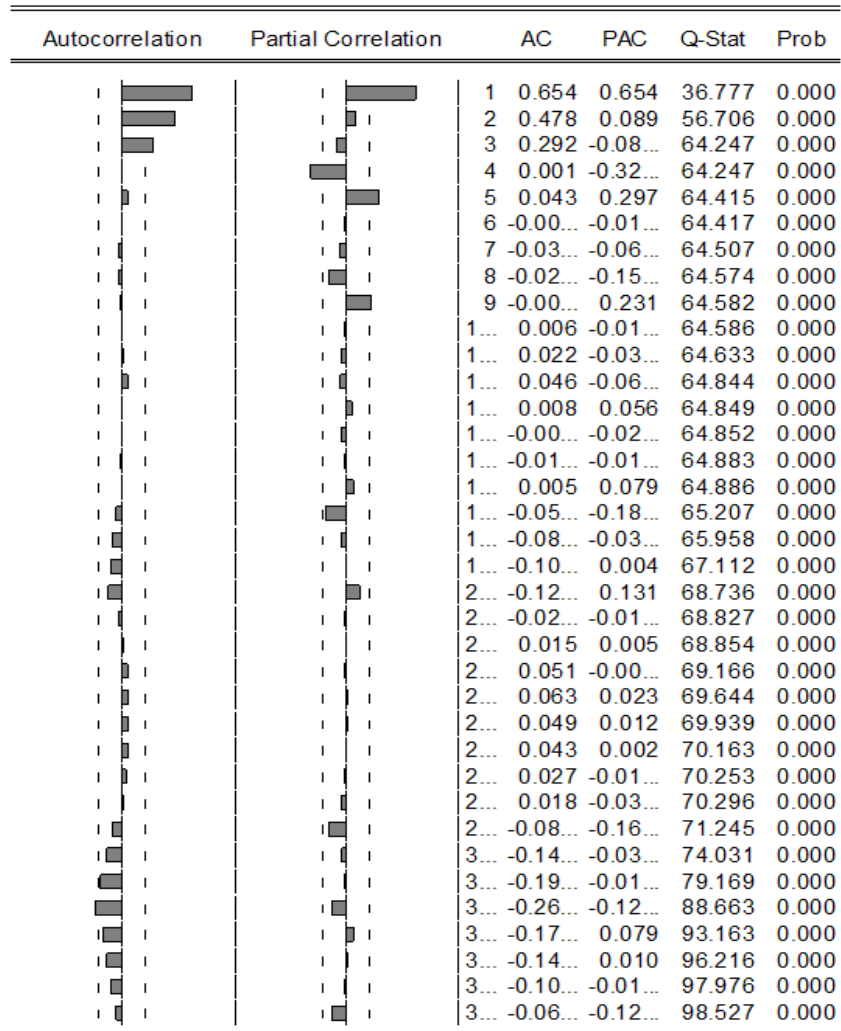


Figure 4. Correlogram of GDPSA after first difference (DGDPSA). Source: Eviews 9 Output.

Table 1. Estimated ARIMA (0,1,3).

Dependent Variable: DGDPSA				
Method: ARMA Maximum Likelihood (OPG - BHH...)				
Date: 10/29/15 Time: 11:12				
Sample(adjusted): 1994:2 2014:4				
Included observations: 83 after adjusting endpoints				
Convergence achieved after 18 iterations				
Backcast: 1993:3 1994:1				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
MA(1)	-0.846074	0.079490	-10.64381	0.0000
MA(2)	-0.756934	0.079598	-9.509519	0.0000
MA(3)	-0.837983	0.046018	-18.20977	0.0000
R-squared	0.704842		Mean dependent var	0.058445

Table 2. Cont'd.

Adjusted R-squared	0.697463	S.D. dependent var	0.269200
S.E. of regression	0.148069	Akaike info criterion	-0.946801
Sum squared resid	1.753954	Schwarz criterion	-0.859373
Log likelihood	42.29226	Durbin-Watson stat	2.164340
Inverted MA Roots	0.06 -0.93i	.06+0.93i	-0.96
ARCH Test:			
F-statistic	18.05054	Probability	0.000058
Obs*R-squared	15.09573	Probability	0.000102

Source: Eviews 9 Output.

Date: 10/29/15 Time: 11:52
 Sample: 1994:1 2014:4
 Included observations: 83
 Q-statistic probabilities adjusted for 3 ARMA terms

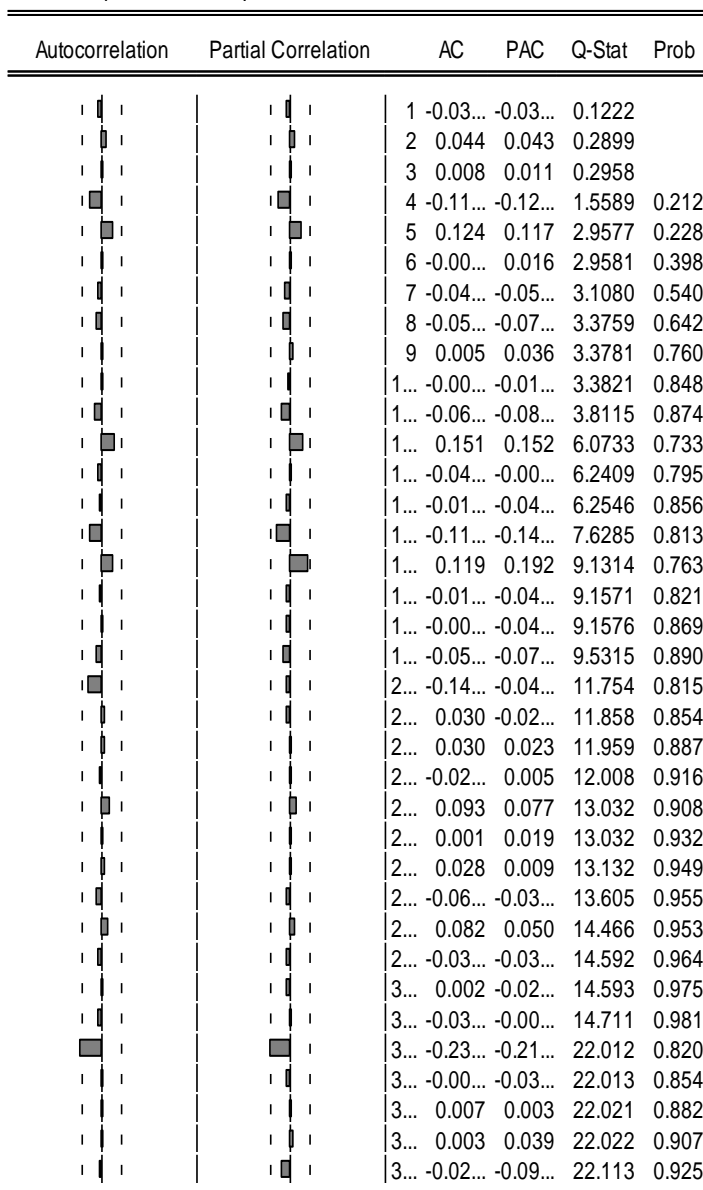


Figure 5. Correlogram of Residuals. Source: Eviews 9 Output.

Table 5. Estimated ARIMA (0,1,3)/GARCH(1,2).

Dependent Variable: DGDPSA				
MA backcast: 1993:3 1994:1, Variance backcast: ON				
	Coefficient	Std. Error	z-Statistic	Prob.
MA(1)	-0.778241	0.067371	-11.55153	0.0000
MA(2)	-0.663977	0.050183	-13.23123	0.0000
MA(3)	-0.818884	0.033676	-24.31626	0.0000
Variance Equation				
C	0.013918	0.006297	2.210291	0.0271
ARCH(1)	0.577803	0.167633	3.446824	0.0006
GARCH(1)	-0.508768	0.223608	-2.275267	0.0229
GARCH(2)	0.126521	0.083293	1.518985	0.1288
R-squared	0.699721	Mean dependent var		0.058445
Adjusted R-squared	0.676015	S.D. dependent var		0.269200
S.E. of regression	0.153228	Akaike info criterion		-1.154023
Sum squared resid	1.784383	Schwarz criterion		-0.950025
Log likelihood	54.89197	Durbin-Watson stat		2.028309
Inverted MA Roots	0.09+0.92i	.09 -.92i		-.97
ARCH Test:				
F-statistic	0.000127	Probability		0.991026
Obs*R-squared	0.000130	Probability		0.990886

Table 6. Estimated ARIMA (0,1,3)/E-GARCH(1,2).

Dependent variable: DGDPSA				
MA backcast: 1993:3 1994:1, Variance backcast: ON				
	Coefficient	Std. Error	z-Statistic	Prob.
MA(1)	-0.835273	0.067511	-12.37244	0.0000
MA(2)	-0.693393	0.056529	-12.26612	0.0000
MA(3)	-0.831580	0.033022	-25.18233	0.0000
Variance Equation				
C	0.028453	0.094023	0.302614	0.7622
RES /SQR[GARCH](1)	-0.235068	0.027465	-8.558732	0.0000
RES/SQR[GARCH](1)	-0.322097	0.047638	-6.761345	0.0000
EGARCH(1)	0.602136	0.066829	9.010119	0.0000
EGARCH(2)	0.356777	0.082554	4.321723	0.0000
R-squared	0.696909	Mean dependent var		0.058445
Adjusted R-squared	0.668621	S.D. dependent var		0.269200
S.E. of regression	0.154966	Akaike info criterion		-1.254413
Sum squared resid	1.801093	Schwarz criterion		-1.021272
Log likelihood	60.05814	Durbin-Watson stat		2.180181
Inverted MA Roots	.08+.91i	.08 -.91i		-.99
ARCH Test:				
F-statistic	2.659603	Probability		0.106857
Obs*R-squared	2.638380	Probability		0.104310

Source: Eviews 9 Output.

Table 7. Model selection criteria.

Criteria	ARIMA (0,1,3)	ARIMA (0,1,3)/GARCH(1,2)	ARIMA(0,1,3)/E-GARCH (1,2)
RMSE	0.145	0.146	0.147
MPAE	109.105	108.59	107.66
MAE	0.105	0.105	0.1044
U-Statistics	0.2897	0.2944	0.2938

Source: Eviews 9 Output.

Table 8. Projected quarterly growth rates (%) for Cameroon.

Year	ϵ_t	DGDPSA	GDPSA	Seasonal coefficients (SA)	Projected future values	China's annual growth rate	
						Year	Annual growth rate (%)
2014:q2	-0.0541					1982	9.02
2014:q3	-0.0683					1983	10.75
2014:q4	-0.0628		5.8662			1984	15.21
2015:q1		0.19944	6.06563	0.99956	6.06294	Source: WDI (2014)	
2015q2		0.00885	6.07449	0.99905	6.06871		
2015:q3		0.04501	6.11949	1.0031	6.13848		
2015:q4			6.11949	1.00103	6.12582		

Source: Author's Calculations Based on Estimated Results.

model for forecasting Cameroon's future economic growth rate. ARIMA (0,1,3) though is good, was rejected because it exhibited a heteroskedastic property (Table 7).

Projections based on ARIMA (0,1,3)/E-GARCH (1,2)

The study used the method employed earlier by Dobre and Alexandru (2008) adopted from Bourbonnais (2005:256). The itinerary for the projection based on the estimated results in Table 8 is as follows:

$$DGDPSA_t = (1 - 0.83527D - 0.693393D^2 - 0.83158D^3)\epsilon_t$$

$$DGDPSA_t = \epsilon_t - 0.83527\epsilon_{t-1} - 0.63393\epsilon_{t-2} - 0.83158\epsilon_{t-3}$$

The residual values for the last three quarters are:

$$\epsilon_{2014:4} = -0.0628; \epsilon_{2014:3} = -0.06830; \epsilon_{2014:2} = -0.05412.$$

The above result suggests that Cameroon's economic growth rate will increase approximately from 6.06% to 6.07% and to 6.13% in 2015 quarters 1, 2 and 3 respectively and will drop thereafter by 0.012% in quarter 4. This implies that Cameroon cannot sustain a steady growth path. On an average, Cameroon's annual growth rate will be approximately 6.099% everything being equal. The results show that the growth pace is still very slow as compared to China that maintained a steady and sustainable annual growth rate of 9.02 and 10.75% in

1982 and 1983 and jumped significantly to 15.21% in 1984 just immediately after the transition program to emergence was initiated. Therefore, policy makers in Cameroon need to double their efforts if they really want to fructify the vision of an emerging economy by the year 2035.

Conclusion

Cameroon is among the African countries aspiring to become an emergent economy by the year 2035. The fundamental objective of this study was to project Cameroon's future economic growth rate and to ascertain whether policy makers could maintain a steady and sustainable growth rate like China that transcended from a developing economy into an emerging economy. The study employed the ARIMA/GARCH models and concluded that the ARIMA (0,1,3)/E-GARCH(1,2) is the best model for projecting Cameroon's future growth rates and relevant for policy implication. This model is very appealing because the forecasted results are in conformity with the current annual growth rate of Cameroon as established by the government in December.

An important finding from this study is that Cameroon's growth pattern is slow and not sustainable. Therefore, Cameroon's policy makers need to double their efforts in order to become like China by the year 2035.

Conflict of Interests

The author has not declared any conflict of interests.

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Full Length Research Paper

Petroleum resources and Nigeria's poverty profile

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Received 27 July, 2016; Accepted 18 October, 2016

Nigeria as one of the oil producing and resource rich nations in sub-Sahara Africa, with her considerable contribution to the world total oil output still maintained high level of poverty among her teeming population. The present development in the oil industry has demanded for an empirical investigation into why despite the endowed petroleum resources, the Nigeria's poverty level has not positively improved. The study however, employed Vector Auto-regression (VAR) model, with cumulative Impulse-response and variance Decomposition Analysis using time series data between 1981 and 2012. The study revealed high rate of poverty despite the numerous advantages derived by the country from petroleum resources. The unfolding event is that the country experienced increasing revenue from petroleum products with corresponding increase in poverty level. The study however suggested an improving capacity of oil production for domestic market, as well as transparent and judicious use of oil proceeds to affect the lives of many Nigerians positively and reduce poverty level in the country.

Key words: Petroleum resources, resource curse, vector auto-regression, poverty rate, Nigeria.

INTRODUCTION

Most Nigerians still live below the poverty line despite the fact that the country is blessed with both human and material resources. Empirical evidence has been adduced to show that there is a tendency for resource-rich countries to be underdeveloped, and for the majority of their citizens to live below the poverty line. The discovery of oil and gas in Nigeria, according to Udosen et al. (2009), dated back to 1958 with an initial output of about 5,100 barrels of oil per day (bpd).

However, the country's oil output rose sharply in the subsequent years, reaching a peak of about 2.4million barrels per day (bpd) in 1979 and the output has in the recent times hover around this figure. The economy has since depended on oil and gas to survive. To put Nigeria's

dependence on oil proceeds in its correct perspective, an analysis carried out to determine the contributions of the oil and non-oil sectors to the Federation Account showed that the contributions of the oil sector to the total revenue accruable to the Federation Account were 83.5, 76.5 and 71.1% for the year 2000, 2001 and 2002 respectively. This decline might not be unconnected to the Niger-Delta crisis that has negatively affected oil exploration and processing. Comparatively, those of the non-oil sector were 16.5, 23.5 and 28.9%, respectively for the same period (CBN, 2012). Also, the actual contribution of petroleum resources to the Gross Domestic Product (GDP) of this country up to the end of the 1990s hovered between 34 and 35%.

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This development is worrisome when you consider it against the notion that oil as a commodity is exhaustible, non-renewable and worse still, easily prone to the effects of international politics and market forces. The concern here is that the country needs to take the advantage of its abundance and the volatile global oil market to better the lives of the citizenry because the opportunities might not last forever.

Anecdotal evidence has often assumed that countries that greatly depend on natural resources for their livelihood are more likely to have economic growth and sustainability; however the converse is true for most of such countries around the world. It is worthy of note that our near absolute dependence on oil as a source of budget funding by various tiers of government in the country largely affects the implementation of these budgets negatively. For instance, Nigeria experiences budget failure whenever there is a price crash in the international oil market. Worse still, the country's situation is compounded by the problems of lack of accountability and transparency in the oil-sector. The way and manner by which the oil and gas sector has been managed has been the bane of development of the sector with its attendant effects on the ever increasing rate of poverty and hunger in Nigeria.

Ordinarily, our present position in the committee of oil producing economies in the world portends that an average income earner in Nigeria, should live above poverty line as described by the United Nations. It implies that Oil rather than be a blessing, has been a curse to the nation. Nigeria's overdependence on oil resources seems threatens not only the security of the nation but also its existence as a corporate entity. The restiveness of the youths in the oil producing areas and the incessant call for resource control by the political class was as a result of the country's overdependence on petroleum products.

That Nigeria is one of the highest producers of crude oil in the world today makes it a beneficiary of windfalls occasioned by sharp price increases. However, the uses of such windfalls have continued to be a source of concern to our economists and other stakeholders in the sector and the economy at large. Rather than use such earnings to deliberately plan and manage a huge savings for raining days as well as a diversification process that would sustain a higher rate of economic growth, they are spent as if they are a mere part of recurrent income. It is worthy of note that countries such as Saudi Arabia, Brazil, Qatar, Indonesia, Botswana have succeeded in using their windfalls to the benefit of their economies, but the reverse is the case in Nigeria. If Nigeria must enjoy dividends such as desired economic growth, generation of employment opportunities, national security in terms of reduction of armed attacks by the insurgent groups on the country's citizen and top Government functionaries, which hitherto has been attributed in various quarters to be the aftermath of youth idleness, unemployment and poverty; the God given resources especially petroleum

should be well spread and utilized for the good of all citizenry. Meanwhile, with the recorded increase in foreign exchange earnings and reserves over the years from petroleum products, it is imperative to find out why Nigeria's poverty status has refused to change positively. Therefore, this study specifically examines the effect of petroleum resources on Nigeria's poverty level, between 1981 and 2012.

LITERATURE REVIEW

Various authors have used different model to analyze and assess the effects of petroleum resources on poverty level in Nigeria and other economies of the world. This study begins the theoretical underpinnings with the consideration of Dutch disease Syndrome. The impediments of oil revenue to economic growth and development of oil-dependent states is what is cumulatively called Dutch Disease in the of development economics literature.

According to Otawa (2001) "a variant of the resource curse called the Dutch Disease can cause an enormous influx of cash from oil to foster wasteful, overzealous and imprudent expenditure. The resulting rising oil revenue can raise exchange rates sales which can promote adverse balance of payment as the cost of imports rises, killing incentive to risk investment in non-oil sectors, the competitiveness of all non-oil sectors such as agriculture and manufacturing industries may thus have been crowded out since the employment of both labour and other resources has been exchanged for unemployment as the government and private expenditure multipliers have been exported abroad."

Otaha (2012) further noted that "in some places like Niger-Delta region of Nigeria, oil revenue allowed continuous conflict, as commercial oil extraction has repeatedly been a source of the conflict. All too often, the economic benefits accrue to a small business or government elites, as well as the agent of multinational companies while on array of burdens such as expropriation of land, disruption of traditional ways of life, environmental devastation, are imposed on local communities unabated. In response to the application of neo-liberal policies coordinated and imposed through the International Monetary Fund (IMF), World Bank and World Trade Organization in conjunction with local political networks, local communities have to fight against not only the companies seeking to plunder their land, livelihood, culture and habitat but also to work against a judicial system that, far from defending their rights, makes laws in order to take the communities' rights away". The role of political elites with multinational companies who are the agents of IMF, World Bank and World Trade Organization creates weak environmental regulations, preferential tax regimes, cheap and legally unproductive labour. These conditions allow companies

to operate with disregard for the affected communities and to use destructive processes, toxic substance and pollutants that are banned or severely restricted in developed countries. All these negative variables that accompanied the exploitation and sale of oil are what economists referred to as Dutch Disease.

Another theory which underlies the relationship between resources abundance and poverty is the institutional model which shifts its attention from the behaviour of the political elites to the nature of political institutions. The argument is that where there are weak political, bureaucratic and economic institutions corruption tends to thrive. What then prevails, in spite of resource abundance, is poor economic policy or management. As the economy is not protected against commodity price fluctuations, authoritarianism tends to result; and the rate of economic growth declines. The solution is obvious: build strong institutions; embark on policies that stimulate economic diversification; institute mechanism to cushion the effects of price fluctuations; intensify taxation; abuse of democratic values among others. This model has received significant attention; it is believed to be closer to reality than other related state model. It strengthens weak political and economic institutions in particular, and in general, embarking on good political, economic and corporate governance, as well as constitutes the appropriate response to resource curse (Asobie, 2011).

However, the institutions-augmented Solow model which is a modified version of the Solow (1956) model, postulated that final goods are produced using a constant return to scale (CRS) technology in a market characterized by perfect competition. Institutions are assumed to play a central role in determining factors' productivity and technology adoption, so that output (Y) is produced according to the following production function:

$$Y = f(A(T,t), K(T,t), L(T,t)) \quad (1)$$

where L denotes labour, $A \geq 1$ is an index denoting the quality of institutions, and t is time level of state-of-art technology, K is capital, T is an index of institutions. We assume that the representative economy is small and has access to a pool of technology generated exogenously that grows at a constant rate of g . In addition, the growth rate of the labour force and the labour force participation rate are constant over time, where n is the population growth rate. Moreover, T is assumed to be increasing with the quality of institutions and, for simplicity, normalized to range between zero and one (Therefore, is equal to one for an economy with the best relative institutions). The Equation poses a major question: how do institutions affect the adoption of available technologies and the productivity of physical capital. Tebaldi and Elmslie (2008) argued that poor institutions prevent the use of available technologies and limit the efficiency gains from current innovation. It's worthy of note, that effective

institutions improve the efficacy of technology and augment the productive capacity of both labour and capital. With respect to capital, it has been shown that poor institutional arrangements (due its tendency to inducements in form of corruption and poor enforcement of laws and contracts) which brings about a decrease in returns to investments and impair capital accumulation.

"The tragedy of the common" is another hypothesis put forward by Hardin (1968) to explain resource ownership and management. The hypothesis posited that lack of common resources ownership was doomed to over exploitation. Common property rights were seen as the causal factor behind resources destruction because it would be in users' private interest to harvest the resources as soon as possible, before other users. When everybody owns the resources, nobody has incentive to conserve it for future use. Each user imposes an external cost on all other users in terms of reduced resources availability. In the absence of property rights, the externality of future scarcity is not internalized by individual users and the outcome is inefficient and high intensity utilization. The consequence is overgrazing, overfishing, appropriation of irrigation water, clearing of forests among others. Such resource use is inefficient because at lower intensity of use, resource stock and output would be higher while the harvesting costs would be lower. The hypothesis further explains that overuse can endanger the sustainability of the resource. The 'tragedy of the commons', as put up in Hardin, has been regarded by Heltberg (2002) to be in tandem with Olson's Logic of Collective Action (1965). According to him, the problem of coordinating resource users to limit their exploitation has free-rider problem similar to organizing potential beneficiaries to contribute towards a public goods.

Undertaking investment that would enhance the value of the resources suffer from similar free-rider problems. Therefore, under-investment in common property may result. The policy implication of the 'tragedy of the commons' hypothesis is to either privatise or nationalise the resources, that is, vesting property rights in the individual or the state. The view is that resource under a well-coordinated and conscious control will be efficiently harnessed by the managers.

Resource curse

The reason why some countries with natural resources endowment seem to have slow growth and development has been blamed on the resource curse phenomenon. The resource curse simply referred to as the 'Paradox of Plenty'. It refers to the paradox that countries and regions have less economic growth and development than countries with fewer natural resources (Ross, 2015). This is hypothesized to happen for many different reasons, including a decline in the competitiveness of other

economic sectors (caused by appreciation of the real exchange rate as resource revenues enter an economy), volatility of revenues from the natural resource sector due to exposure to global commodity market swings, government mismanagement of resources, or weak, unstable or corrupt institutions (possibly due to the easily diverted actual or anticipated revenue stream from extractive activities).

Humphreys et al. (2007) opined that resource curse is characterized by countries with large endowments of natural resources such as oil and gas but often perform worse economically and politically than countries with fewer resources. Evidence of this can be seen in some resource-rich countries like Nigeria, Sudan, Congo and Angola among others, which are suffering from different civil, political and economic problems while countries like Hong Kong, Taiwan, Singapore achieved their rapid economic growth without large natural resource reserves but rather through a boomed exportation of manufactured goods.

Some authors such as Sachs and Warner (2001) and Gylfason (2001) are of the opinion that there is a correlation between abundant mineral resources and a negative economic and political outcome. Weinthal and Luoug (2006) also stated that the more intense a country's reliance on mineral exports (measured as a percentage of GDP) the more slowly its economy grew. Based on their survey, GDP per capita in mineral-rich countries increased by 1.7% while that of mineral-poor countries increased by 2.5 and 3.5% between 1960 to 1990. Gylfason (2001) also observed that from 1965 to 1998 gross national product per capita in OPEC countries decreased on average by 1.3 percent while there was a per capita growth by an average of 2.2% in the rest of the developing world. Collier and Hoeffler (2002) in their own estimates revealed that natural resources have a strong and non-linear effect on conflict, thereby capable of increasing the chances of civil conflict in a country.

Inversely, the problems of inefficiency, excessive borrowing, bribery and corruption, Lack of diversification and enclave effects, which characterize the public sector of the Nigerian economy, (with no exception on the oil and gas industry which is the major source of government revenue), have for a long time being left unaddressed. All these have been widely responsible for the persistent increase in poverty level and birth of various social vices in the country. However, various researchers have suggested various measures to abate the series of problems breeding poverty in the country; such measures include the inculcation of true self-discipline and fear of God through religious teachings and exemplary behaviour from leaders at all level. Other measures are periodic and timely review of salaries and wages in line with prevailing cost of living to discourage workers from supplementing legal income with illegal income, and the involvement of consultants to run public enterprises or perform certain functions on behalf of government instead

of privatization of everything owned or done by government.

However, privatization and the use of private consultants may become necessary when corruption and inefficiencies persist in the public sector. The government has also in the recent times made unsuccessful efforts at addressing the issues of poverty through the initiation of various policy documents such as National Economic Empowerment and Development Strategy (NEEDs), Extractive Industry Transparency Initiatives (EITI), Public-Private Partnership (PPP) and introduction of Petroleum Industry Bill (PIB) for legislation, which has attracted so much controversy from different segments of Nigerians. All these efforts are in the bid to address the rot in the oil and gas in order to create wealth and reduce poverty in the country. On the surface, this seems to be an impressive record, but it is not clear whether any of these has been able to bring about the much anticipated changes in the sector and also whether the funds accrued to that sector had been transparently and judiciously used. It is also not clear whether the impact of funds earmarked for projects development in the oil sector had been significantly felt by the oil producing communities, in terms of reducing the incidence, depth and severity of poverty in the oil region. What is clear however is that poverty still remains pervasive, based on the available studies reviewed.

Figure 1 presents the growth of Oil revenue (GORV) and poverty (POR) situation in Nigeria between 1981 and 2012. It is evident from the above that despite the level of volatility that ravaged the global oil market since the 1980's, Nigeria has recorded a sharp and tremendous increase in the amount of revenue accrued from oil from the early 1980's to around the mid 2000's. But the oil revenue recorded a fluctuation and plummeted fairly towards the end of the decade. In spite of this, the country in the same rate recorded an embarrassing increase in the rate at which the citizenry get poorer by having as high as close to 70% of the entire population trapped in poverty. It is worthy of note that Nigeria has been ranked as the sixth largest producer of oil in the world, but the country has not utilized the opportunities to better the lot of citizenry in terms of welfare and poverty alleviation. However, from the conclusion of Omadjohwoefe (2011) where it was asserted that "this unprecedented nature of poverty in Nigeria had become more disturbing when viewed against the background of her enormous human and natural resources". He further stated that "various regimes have responded through numerous interventionist programmes to eradicate poverty but with no desired results. In other words, the more Nigeria tries to tackle poverty the more it persists". The situation of Nigeria is comparable to the case of "acute and continuous deprivation and hunger in the midst of plenteous wealth". Nigeria has also found it difficult to provide basic infrastructures that are believed to be useful in giving the citizenry a worthwhile living and

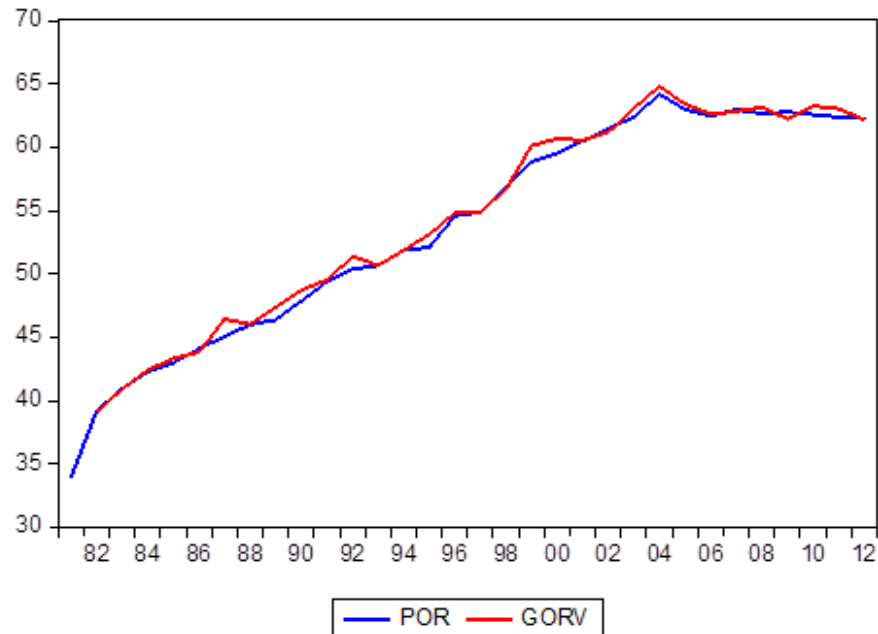


Figure 1. Poverty-oil revenue profile in Nigeria (Source: Computed from CBN statistical bulletin and annual reports and statement of accounts between 1981 and 2012).

alleviating their poverty, despite the huge amount of resources available at her disposal (Omadjohwoefe, 2011).

Empirical evidence

Several authors have written to examine and investigate how management of natural resources such as oil and gas has affected the level of poverty in different economies of the world especially in Nigeria. One of such study is the one carried out by Odularu (2008) where he used the Cobb-Douglas production function to analyze the relationship between the crude oil sector and the Nigerian economic performance using the Ordinary Least Square of multiple regression method and revealed that; "Capital, labour force and oil production can surely lead to economic growth. He suggested that in order for the government to improve people's welfare with the various impacts of crude oil production (for domestic consumption and export), the government must participate by making policies that will encourage the private sector to participate actively in the economy".

Meanwhile, Akinwale (2012) empirically examined the existence of resource curse in Nigeria using ordinary least square of regression analysis on primary data and established various factors that bring about the existence of resource curse in Nigeria, such as Dutch Disease, poor technological advancement, volatilities of oil price, high level of corruption, authoritarian regimes/poor

democracies, high level of indebtedness, poor investment in education, weak and unaccountable institutions, as well as insurgency in the oil producing region".

The study however, concludes "that weak institutions and poor technology are the greatest impediments to escaping resource curse". Also, Manzano and Scrofina (2013) in their study on "the resource revenue management in Venezuela:

"A consumption-based poverty reduction strategy", concluded that "the windfall in oil rent has been mostly appropriated by the government through different channels such as the national oil company, which is still the biggest producer in the country".

They further revealed that "in terms of priorities, the main objective of Venezuela government has been to spend money to alleviate poverty, with mixed results. Venezuela has also made tremendous progress in poverty reduction. In addition, according to the authors, government has dedicated resources to bolstering the role of the state in the economy, such as expropriating or buying numerous private enterprises, which has great impact on the private sector investment". Emerging from the reviewed studies, Nigeria has been identified as one of the few countries endowed with abundant mineral resources, especially petroleum, which ranked her as the sixth largest producer of oil in the world. But in spite of this, the country still maintained high level of poverty; and unable to utilize the opportunities of accrued oil revenue to improve the poverty status of the citizenry. This negative trend

between the accrued revenue from oil and poverty level in Nigeria has provided a gap in the literature, which the study tends to fill.

METHODOLOGY

The model

In consonance with the Solow's model of economic growth which is based on the premise that output in an economy is produced by a combination of labour (L) and capital (K) under constant return to scale hypothesis, so that doubling input results in doubling output. Contemporary versions distinguish between physical and human capital. Thus, the quantity of output (Y) is also determined by the efficiency (A) in which capital and labour is used. The model is quantitatively expressed as follows:

$$Y = A f(L, K) \quad (2)$$

The model further assumed that the production function exhibits constant returns to scale, that is, if all inputs are increased by a certain multiple, output will increase by exactly the same multiple. In this case, Y is gross domestic product, K is stock of capital, L is labour and A represents the productivity of labour, assumed to grow at exogenous rates. In order to achieve the objective of this study, the model is thereby modified and therefore specified functionally as follows:

$$POR = f(ORV, CGS, DOC, XPO) \quad (3)$$

Explicitly, the model to examine how the management of petroleum resources, which has been in abundance in Nigeria, has been able to affect the poverty profile in the country is written as follows:

$$POR = \beta_0 + \beta_1 ORV + \beta_2 CGS + \beta_3 DOC + \beta_4 XPO + \mu_i \quad (4)$$

The growth rate of each of the explanatory variables was computed to enable it achieve the objective of the study; and the model is re-written as follows:

$$POR = \beta_0 + \beta_1 ORV + \beta_2 CSG + \beta_3 DOC + \beta_4 XPO + \mu_i \quad (5)$$

Where; POR = rate of poverty, proxy by poverty rate in Nigeria. Poverty has been described as scarcity, dearth, or the state of one who lacks certain amount of material possession or money. It is referred to as the state of which a person or group of persons are unable to provide the basic necessities of life for themselves.

ORV = Oil revenue

This is the total amount of money accruing from the sale of crude by the government of Nigeria. The value according to the data base was in line with the stated and predetermined Oil bench mark in the annual budget of the country.

CSG = Crude oil share of GDP

This is referred to as the total monetary value of GDP that petroleum products accounted for. The value of this is relatively

high compared to the GDP mainly because the Nigerian Economy has widely been regarded as a mono economic one.

DOC = Domestic oil consumption

This is the country's total consumption of refined petroleum products in barrels per day.

OXP = Crude oil export

This entry includes the total oil exported in barrels per day (bbl/day), including both crude oil and oil products in each year. This value is usually quoted in millions.

Analytical method

In order to establish the relationship among the variables in the established model used in this study, the Vector Auto Regressive method of Analysis (VAR) was employed. From the literature, different techniques have been adopted to capture the impact of various macro-economic indicators on particular variables. Odularu (2008) used ordinary least square method of regression (OLS) to establish the effects of Crude Oil on the Nigerian Economic performance which later failed to distribute the expected response of resources management effects on output growth. Gujarati (2007) also suggested that the vector Auto- regression (VAR) is a more realistic technique to capture Oil and energy resources effects since these are prone to external shocks and influences. Besides, the superiority of the VAR model over the OLS is quite clear. The OLS assumes a particular variable to be endogenous while the rest are exogenous. Vector Auto- regression (VAR) is a statistical model used to capture the linear interdependencies among multiple time series. All variables in VAR model are treated symmetrically in a structural sense; (although the estimated quantitative response coefficients will not in general be the same) each variable has an equation explaining its evolution based on its own lags and the lags of the other variables in the model.

Data requirement and source

The data for this study is mainly secondary, which include poverty rate as a percentage of the head count population (POR), the rate of change in oil revenue (ORV), crude oil share of the gross domestic products ($GCSG$), domestic consumption ($GDOC$) and oil export ($GOXP$), which encompasses the value that goes into excess crude account. The data for these variables specifically the poverty rate, were obtained from the World Development Index (WDI) as published on country basis by the World Bank. Other required data were obtained from CBN Statistical Bulletin and Annual Reports and Statement of Accounts specifically between 1981 and 2012.

RESULTS AND DISCUSSION

The discussion of the analysis in this study begins with a post-estimation stationary test, using the Augmented Dickey Fuller (ADF) test statistics. In order to achieve the specific objective of the study, all the exogenous variables were transformed into their growth function.

Table 1. Unit root Test (Augmented Dickey fuller).

Variable	ADF STAT.	Critical value@5%	Order of INT.
POR	-4.062401	-2.960411	I(0)
GORV	-5.001970	-2.967767	I(0)
GCSG	-5.286142	-2.963972	I(0)
GDOC	-7.548175	-2.963972	I(0)
GOXP	-6.600242	-2.963972	I(0)

Source: Author's computation, 2014.

Table 2. Vector Auto- regression (VAR) estimates.

Variable	POR	GORV	GCSG	GDOC	GXPO
POR(-1)	1.018599	0.223326	0.016602	-0.150836	-0.091981
POR(-2)	-0.055273	-0.223681	-0.018111	0.147125	0.104598
GORV(-1)	-0.117518	-0.168341	0.021485	-0.007573	0.214050
GORV(-2)	-0.137176	-0.326893	-0.013596	0.141794	-0.535236
GCSG(-1)	3.912909	0.116451	-0.099604	-0.480667	-5.331683
GCSG(-2)	-1.591690	0.910787	-0.149369	-0.972886	-1.783737
GDOC(-1)	0.175283	-0.124461	-0.009706	-0.425975	-0.986452
GDOC(-2)	-0.387033	0.485758	0.036774	-0.242302	-0.219070
GXPO(-1)	-0.047976	0.056859	0.008122	-0.050624	-0.286555
GXPO(-2)	-0.144972	0.038855	0.000322	-0.025758	-0.117509
C	2.858846	0.272139	0.089926	0.477453	0.696505
R^2	0.992010	0.393875	0.223139	0.376554	0.230593
<i>F-Stat.</i>	223.4812	0.943381	0.517018	1.087177	0.539464

Source: Author's computation, 2014.

Analysis of pre-estimation test

Table 1 presents the results of the Augmented Dickey Fuller (ADF) test statistics. The results indicate that all the variables were stationary at level, that is integrated order zero {I (0)}. This implies that none of the variables contain a unit root. In view of the above and considering the fact that the series are I(0) variables, the study therefore proceed further by specifying an unrestricted Vector Auto-Regression model with the post-estimation tests of Impulse-response, Cumulative Impulse-Response and Variance decomposition respectively.

Vector auto-regression (VAR) test

Table 2 presents the results of the unrestricted VAR model, and it shows the direction of causality of the endogenous variables. The VAR model treats all variables as endogenous. Table 2 thus portrays the endogenous level as well as simultaneous comparison of both the F-Statistics and the co-efficient of multiple determinations (R^2). The VAR results show that Poverty level in Nigeria, denoted as (POR) appeared to be more endogenous

than being exogenous with the R^2 of about 99.2% and a correctly fitted F-statistics of 223.4812. The remaining variables such as the growth rates of Oil revenue (GORV), share of crude oil in the GDP (GCSG), Domestic oil consumption (GDOC) and Oil export (GOXP) were shown to be less endogenous with their respective R^2 of 39.4%, 22.3%, 37.7% and 23.1%; and F-statistics of 0.943381, 0.517018, 1.087177 and 0.539464 respectively. In the result, growth rate of Oil revenue and the Crude oil share of the GDP both maintained positive relationship with one lagged value of the poverty level in the country while the growth rates of the domestic oil consumption and the oil export, both put up negative posture with the level of poverty in Nigeria. This estimate provides the evidence that as the country makes more income from the oil resources owing to increasing rate of production of the petroleum products; an average person on the street of Nigeria has not felt any impact of such and these alone has been responsible for the ever increasing level of poverty among the populace. However, this result corroborates the study of Odularu (2008) despite its shortcomings. He concluded that "the production of crude oil (domestic consumption

Table 3. Impulse-response to One S.D. of POR.

Period	POR	GORV	GCSG	GDOC	GXPO
1	0.825427	0.000000	0.000000	0.000000	0.000000
2	0.882885	0.008092	0.276007	0.062306	-0.077022
3	0.868206	-0.111261	0.182403	-0.009554	-0.263077
4	0.859136	-0.055517	0.158522	0.073120	-0.207506
5	0.782864	-0.046111	0.206992	0.037941	-0.210856
6	0.772460	-0.038032	0.154043	0.020449	-0.200747
7	0.744824	-0.038621	0.167008	0.048422	-0.171871
8	0.691437	-0.048633	0.164745	0.033742	-0.183836
9	0.665027	-0.038948	0.137773	0.029085	-0.175451
10	0.637055	-0.034055	0.143032	0.034302	-0.157595

Source: Author's computation, 2014.

and export) despite its positive effect on the growth of the Nigerian economy, has not significantly improved the welfare of Nigerians, due to many factors like misappropriation of public funds (corruption) and poor administration”.

Analysis of post-estimation tests

Impulse-response test

Table 3 presents the results of the Impulse- Response analysis of the Vector Auto- regression (VAR), which traces the effect of one standard deviation shock to one of the innovations on current and future values of the endogenous variables. The impulse- response is used to forecast the pattern of the endogenous variable to a standard deviation shock on the level of poverty, based on the head count of the population of Nigeria. It is apparent from the Impulse- response estimates that a standard deviation shock on the poverty level brings about a sharp increase in poverty rate (POR) per population from the first period to the second period and later showed a gradual reduction from the third period to the tenth period under consideration. Meanwhile, the response of the poverty rate also revealed innovation in the level of poverty, as the oil revenue grows slowly and steadily from the second period to the tenth period. This innovation also showed a decrease in the growth of crude oil share of the GDP, whereas the growth of Domestic oil consumption and oil exports fluctuated from second period to the tenth period under consideration. The implication of the above is that holding all other factors constant, the poverty level in Nigeria may record a gradual but insignificant reduction owing to the fact that the more the oil revenue grows, the higher the level of wastage, maladministration and misallocation of the resources in the country. In like manner, this revelation follows the study of Akinwale (2012) where he concluded

that “weak institutions and poor technology are the greatest impediments to escaping resource curse”.

Cumulative impulse- response test

Table 4 presents the results of the Cumulative Impulse-response estimates which revealed that the poverty level grows cumulatively from 0.825427 in the first period to 7.729320 in the tenth period under review. This implies that the rate at which the poverty rate increases in Nigeria despite the level of revenue that accrues to the country from oil resources, had been so alarming and devastating. Even as the share of crude oil in GDP and domestic oil consumption increases cumulatively. This outcome may be as a result of the fact that Nigeria's domestic oil consumption is characterized by heavy importation and shrouded in high level secrecy and unabated corruption which has cost Nigerians huge amount of resources that could have been used to better their lives. This unquantifiable level of wastage as revealed in the recently publicized fuel importation subsidy fraud led to the popular resource curse syndrome effect on the Nigerian populace. On the other hand, the cumulative decrease in the growth of oil revenue and oil exports may be attributed to the instability in the global oil market which had dwindled the revenue base of the oil exporting economies of the world. This particular situation has gravely affected Nigerian economy being a mono-economic one, solely dependent on oil.

Variance decomposition test

Table 5 also presents the results of the Variance decomposition estimates of the poverty rates (POR) in Nigeria. The variance decomposition measures the proportion of forecast error variance in one variable explained by the innovation in it and other variables. The results revealed that the variation in the rate of poverty

Table 4. Cumulative impulse- response estimates.

Period	POR	GORV	GCSG	GDOC	GXPO
1	0.825427	0.000000	0.000000	0.000000	0.000000
2	1.708312	0.008092	0.276007	0.062306	-0.077022
3	2.576517	-0.103169	0.458410	0.052752	-0.340099
4	3.435653	-0.158686	0.616932	0.125872	-0.547604
5	4.218517	-0.204796	0.823923	0.163813	-0.758461
6	4.990977	-0.242828	0.977966	0.184262	-0.959207
7	5.735801	-0.281449	1.144974	0.232684	-1.131078
8	6.427238	-0.330082	1.309719	0.266426	-1.314915
9	7.092265	-0.369030	1.447492	0.295511	-1.490366
10	7.729320	-0.403085	1.590524	0.329813	-1.647961

Source: Author's Computation, 2014.

Table 5. Variance decomposition of POR.

Period	S.E	POR	GORV	GCSG	GDOC	GXPO
1	0.825427	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.243734	94.43655	0.004233	4.924746	0.250959	0.383511
3	1.554222	91.67869	0.515171	4.530980	0.164484	3.110676
4	1.797314	91.40565	0.480649	4.166121	0.288510	3.659070
5	1.983453	90.63319	0.448714	4.509952	0.273491	4.134649
6	2.143985	90.54988	0.415501	4.376093	0.243166	4.415364
7	2.283134	90.49133	0.395012	4.394001	0.259409	4.460249
8	2.399005	90.26799	0.398872	4.451379	0.254738	4.627017
9	2.499923	90.20377	0.391590	4.402966	0.248122	4.753548
10	2.589032	90.15592	0.382401	4.410304	0.248890	4.802485

Source: Author's computation, 2014.

(POR) explained by the growth in Oil revenue assumed a peak in the third period and thereafter declined towards the tenth period. The oil export on the other hand revealed an increase in the variation explained on the poverty level from the third period towards the tenth period. The results also showed the evidence that the rate of poverty in Nigeria may record a slow and gradual decline over time if the petroleum resources available at her disposal are properly and duly harnessed by the political authority as well as the relevant agencies saddled with operations and management of petroleum resources in the country are alive to their responsibilities. The variance decomposition estimates also showed the level of variation in the poverty rate due to the growth rate of oil export. This situation has portrayed Nigeria as a net exporter of petroleum resources.

CONCLUSION AND RECOMMENDATION

The emerging conclusion from various analyses of the

study is that oil resources which ought to serve as an icing on the cake for many Nigerians turn out to be the bane of development, which is a panacea to poverty alleviation among the teeming population. The country has realized a lot of income including windfalls on several occasions from exploration and sales of oil resources but little or nothing has been shown for that due to massive and uncontrollable level of corruption, mismanagement and misallocation of oil proceed, which has been accruing to coffers of the country since the discovery of oil. Specifically during the period under consideration and for the purpose of this study, the country has really witnessed a high and persistent increase in the demand for petroleum products in the international and local markets. Summarily, the study concludes that the level of poverty among the populace has not been any better despite the continuous increase in the demand for domestic consumption of oil in the country, but for the fact that the country only export crude and not refined products and import refined products for local consumption thereby creating employment and wealth for

the foreign economy. It's a known fact that any economy that sells its products too close to nature will earn meager in return, this study therefore recommends that Nigeria should look inward, build and expand capacity to ensure the country refines her domestic oil needs to be able to create adequate employment and wealth for the system and by implication alleviating poverty in the country. The country should also be more transparent and sincerely make judicious and proactive use of the revenue accruing to her through the exploration and sales of petroleum resources to enable it impact significantly on the lives of the citizenry.

Conflict of interests

The author has not declared any conflict of interests.

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