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Econometric Analysis of the Joint Interaction between Oil Revenue and Governance on Per-Capita Income in Nigeria (1990-2021)

[1]Amadi, O.H., & [2]Binaebi, E.

[1]Department of Agricultural and Applied Economics, Rivers State University Nkpolu- Oroworukwo, Port Harcourt
[2]Department of Agricultural Economics & Extension, University of Africa, Toru-Orua, Sagbama, Bayelsa State

Abstract: *The study econometrically analysed the Joint Interaction between Oil Revenue and Governance on Per Capita Income in Nigeria from 1990-2021.The study adopted the Autoregressive Distributive Lag (ARDL) modelling techniques for the data analysis. Data for the analysis were sourced from secondary sources such as World Data Index (WDI) and CBN Statistical Bulletin (Various-Issues). The results of the analysis indicated as follows; the ARDL ECM regression results showed that in short run, the coefficients; ORV*GOE has a positive (0.000631) relationship with RPI, ORV*ROQ has a negative (-0.000774) relationship with RPI, ORV*COC has a positive (0.000002) relationship with RPI and the coefficient ORV*ROL has a negative (-0.001781) relationship with RPI.The Breusch-Godfrey Serial Correlation LM Test result showed that there is no serial correlation in the model. The Breusch-Pagan-Godfrey Heteroskedasticity Test result suggests that there is no evidence of heteroskedasticity in the model. The study concluded that oil revenue and governance has both promoted and hindered economic development in Nigeria within the period under review and recommended that there should be there should be accountability and transparency on the part of government and officials in the management of oil revenues for the benefit of the citizens and the economy as a whole.*

Keywords: Crude oil, Governance, Per-capita, Income

INTRODUCTION

Nigeria is genuinely rich in both categories of natural resources, but still has not been able to sustain the much-needed economic growth. (Bannon & Collier, 2003; Collier & Hoeffler, 2002; Ross 1999, Sachs & Warner, 1995). Nigeria is one of the top ten crude oil exporters in the world. However, its economy had been stagnant and failed to alleviate poverty (Budina, Pang & Van Wijnbergen, 2007). As an illustration, in 1965, when oil revenues per annum were approximately $33 billion, the per capita GDP of Nigeria was US$245. In 2000, when oil revenues were US $325 billion, the per-capita GDP remained at the 1965 level, US $245 (Kablan & Loening, 2012). In 2012 when cumulative oil revenues were well over US $402billion, the per-capita GDP of Nigeria was US $1,630.00 (IMF, 2012). This was still considered negligible for enhancing the welfare of Nigerians. It has been estimated that oil and gas exports accounted for more than 98% of export earnings and about 83% of federal government revenue in the year 2000 (Odularu, 2008). The aim of the study was to determine the effect of crude oil revenue and governance on the per capita income in Nigeria. Governance was proxied by control of corruption, voice and accountability, regulatory qualities, rule of law, government effectiveness and exchange rate.

The aim of the study was to determine the effect of the joint interaction between crude oil revenue and governance on per capita income in Nigeria. Governance was proxied by control of corruption, voice and accountability, regulatory qualities, rule of law, government effectiveness and exchange rate.

Methodology

Research Design

This study adopted the quasi-experimental research design. The choice of this approach emanated from its suitability in assessing the impact of multivariate explanatory variables on a single dependent variable.

Data Collection

The data for this study was time series data obtained from secondary sources such as Central Bank of Nigeria and Federal bureau of statistics bulletin, the World Bank database, the Nigerian national petroleum corporation statistics bulletin, National Bureau of statistics (NBS) and index Mudi for the period of 1990 to 2021.

Data Analysis

This study employed descriptive statistics, unit root test, bound cointegration, and Autoregressive Distributed Lag (ARDL) to estimate the effect of the explanatory variables on the dependent variable.

Model Specification

The model is expressed explicitly as

$$RPI = f(ORV*COC, ORV*VOA, ORV*ROQ, ORV*ROL, ORV*GOE) \quad 1$$

$$RPI_t = \alpha_o + \beta_1 ORV*COC_t + \beta_2, ORV*VOA_t + \beta_3 ORV*ROQ_t + \beta_4 ORV*ROL_t + \beta_5 ORV*GOE_{tt} + U_t \quad 2$$

Where;

RPI = Real Per Capita Income
ORV = Oil Revenue
COC = Control of Corruption
VOA = Voice and Accountability

ROQ = Regulatory qualities
ROL = Rule of Law
GOE = Government Effectiveness
EXH = Exchange Rate
α_o, β = Unknown Parameters
a priori; $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$
The Autoregressive Distributed Lag (ARDL) Model (Bound Test Approach) for the model is specified as follows:

$$\Delta RPI_t = \beta_0 + \Delta RPI_{t-1} + \Sigma\beta_{1t}\Delta ORV*GOE_{t-1} + \Sigma\beta_{2t}\Delta ORV*ROQ_{t-1} + \Sigma\beta_{3t}\Delta ORV*VOA_{t-1} + \Sigma\beta_{4t}\Delta ORV*COC_{t-1} + \Sigma\beta_{5t}\Delta ORV*ROL_{t-1} + RPI_{t-1}\Sigma\Phi_{2t}ORV*GOE_{t-1} + \Sigma\Phi_{3t}ORV*ROQ_{t-1} + \Sigma\Phi_{4t}ORV*VOA_{t-1} + \Sigma\Phi_{4t}ORV*COC_{t-1} + \Sigma\Phi_{4t}ORV*ROL_{t-1} + U_t \quad (3)$$

β_0 is the constant terms, RPI, ORV, COC, VOA, ROQ, ROL, GOE, EXR, are as earlier defined, $\beta_1 - \beta_5$ are the coefficients of independent variables while $\mu$is the error terms, Δ = first difference of the variable, U_t= white noise disturbance error term.

RESU LTS AND DISCUSSION

The trends per capital income is presented in Figure 1

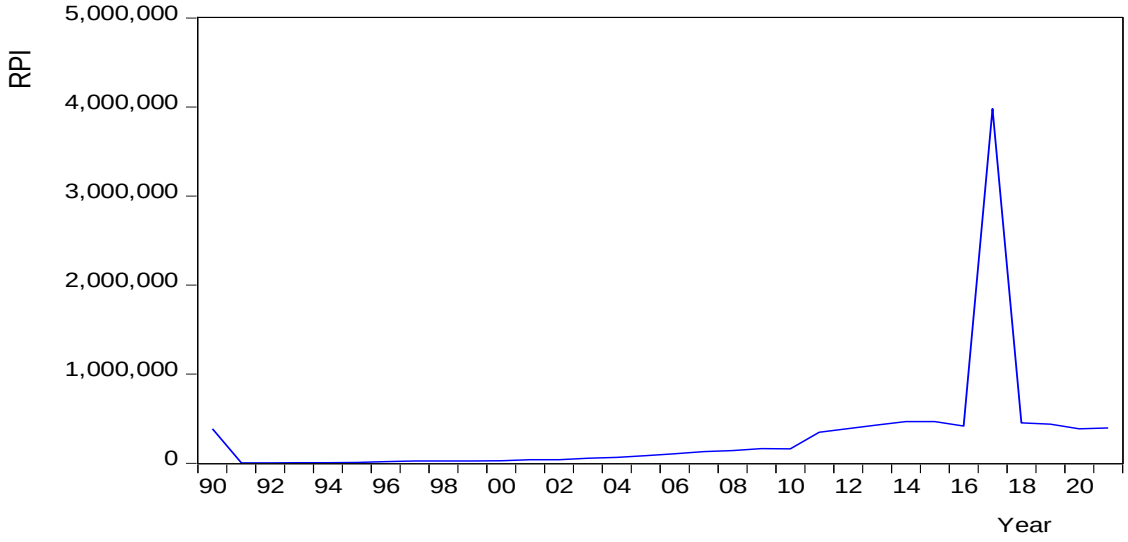

Figure 1: Time Series Plot of Nigeria's RPI (1990-2021)

Figure 1 shows that the values of Nigeria's Real Per Capita income (RPI) have been fluctuating within the period of the study. The value decreased from 1990 to 1992 and later increased steadily in 2015 and increased the following year to its peak in 2017 and dropped down in 2021.

Unit Root Test

Table 1 present the results of the stationarity test for each of the variables in the model using the Augmented Dickey Fuller (ADF) test. The results were conducted with intercept and no trend.

Table 1: ADF at Constant for Joint Interaction Between Oil Revenue and Governance on Per Capita Income

Variable	ADF at Level	ADF at 1st Difference	Status	Remark
LOG(RPI)	-1.441760	-11.03578	I(1)	Stationary
ORV*COC	-5.003495	-	I(0)	Stationary
ORV*VOA	-1.995041	-7.164196	I(1)	Stationary
ORV*ROQ	-2.990132	-7.128108	I(1)	Stationary
ORV*ROL	-1.610315	-6.010464	I(1)	Stationary
ORV*GOE	-1.600841	-5.949366	I(1)	Stationary

Critical Values		
1% level	-3.670170	-3.679322
5% level	-2.963972	-2.967767
10% level	-2.621007	-2.622989

Source: Author's Computation using E-view 10

The results of the unit root test in Table 1 reveals that ORV*COC was stationary at level while RPI, ORV*VOA, ORV*ROL, ORV*ROQ and ORV*GOE were stationary at 1st difference. Hence, the study then concludes that the independent variables used in the model were integrated of both order zero and one, that is I(1) and I(0) and the dependent variable is integrated of order one, that is, I(1). Since the ADF results indicate that the series are of different order of integration, we cannot use the Engle-Granger and Johansen co-integration tests but rather the appropriate test to use in this study is the Bounds co-integration test.

Bound Co-integration Test Result for Joint Interaction between Oil Revenue and Governance on per Capita Income

The result of the Bound Co-integration test is presented in Table 2

Table 2: ARDL Bound Test Co-Integration Result for the Model

Test Statistic	Value	K
F-statistic	4.464284	5
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author's Computation using E-view 10

From Table 2, the result of the bound co-integration test shows that the calculated f-statistic value of 4.464284 falls higher than the theoretical critical value for the upper bound I(1) bound at 5 percent. This means that there is co-integration, hence, a long run relationship exists between ORV*COC, ORV*VOA, ORV*ROL, ORV*ROQ, and ORV*GOE and RPI in Nigeria within the period under review.

Since there is a long run relationship among the variables, we now proceed to estimate the short run dynamics and long run models based on the ARDL approach.

Long Run Estimation Results for Joint Interaction between Oil Revenue and Governance on Per Capita Income

Table 3 shows the estimated coefficients of the long run relationship between the variables in in the model.

Table 3: ARDL Long Run Estimation Result for the interaction between Governance and Oil Revenue on RPI model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ORV*GOE	0.000855	0.001288	0.663776	0.5132
ORV*ROQ	-0.000445	0.000118	-3.760955	0.0037
ORV*VOA	0.000684	0.000300	2.284357	0.0315
ORV*COC	0.000002	0.000020	0.108393	0.9146
ORV*ROL	-0.008450	0.003139	-2.691760	0.0226
C	9.729005	0.419327	23.201485	0.0000

Source: *Author's Computation using E-view 10*

Table 3 shows that in the long run, the interaction between ORV*GOE coefficient has a positive (0.000855) relationship with RPI, meaning that a unit increase in ORV*GOE increases RPI in Nigeria. This implies that a direct relationship exists between ORV*GOE and RPI. The positive sign of the coefficient of ORV*GOE in the long run conforms to a priori expectation. The coefficient of ORV*GOE is statistically significant with RPI at 5 percent level of significance.

While the coefficient of ORV*ROQ has a negative (-0.000445) relationship with RPI, meaning that a unit increase in ORV*ROQ decreases RPI in Nigeria. This implies that an indirect relationship exists between ORV*ROQ and RPI in Nigeria. The negative sign of the coefficient of ORV*ROQ in the long run does not conform to a priori expectation. The coefficient of ORV*ROQ is statistically significant with RPI at 5 percent level of significance,

The table also shows that in long run, the coefficient of ORV*VOA has a positive (0.000684) relationship with RPI, meaning that a unit increase in ORV*VOA increases RPI in Nigeria. This implies that a direct relationship exists between ORV*VOA and RPI in Nigeria all things being equal. The positive sign of the coefficient of ORV*VOA in the long run conforms to a priori expectation. The coefficient of ORV*VOA is statistically significant with RPI at 5 percent level of significance.

Again, in the long run, the coefficient of ORV*COC has a positive (0.000002) relationship with RPI, meaning that a unit increase in ORV*COC increases RPI in Nigeria. This implies that a direct relationship exists between ORV*COC and RPI. The positive sign of the coefficient of ORV*COC in the long run conforms to a priori expectation. The coefficient of ORV*COC is statistically significant with RPI at 5 percent level of significance.

The coefficient of ORV*ROL has a negative (-0.008450) relationship with RPI, meaning that a unit increase in ORV*ROL decreases RPI in Nigeria. This implies that an indirect relationship exists between ORV*ROL and RPI in Nigeria. The negative sign of the coefficient of ROL in the long run does not conform to a priori expectation. The coefficient of ORV*ROL is not statistically significant with RPI at 5 percent level of significance.

Short Run Estimation Results for Joint Interaction between Oil Revenue and Governance on Per Capita Income

The result of the short run dynamics estimation of the model is presented in equation Table 4.

Table 4: ARDL Short Run Estimation Result for the interaction between Governance and Oil Revenue on RPI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ORV*GOE)	0.000631	0.000955	0.661049	0.5149
D(ORV*ROQ)	-0.000774	0.000207	-3.742900	0.0038
D(ORV*VOA)	0.000505	0.000257	1.964588	0.0611
D(ORV*COC)	0.000002	0.000015	0.108377	0.9146
D(ORV*ROL)	-0.001781	0.000310	-5.741697	0.0002
ECM (-1)	-0.738251	0.165046	-4.473001	0.0002
Adj-R^2 = 0.226519; F-stat. = 2.564284 with F-Prob. = 0.043286; and DW = 1.910562				

Source: Author's Computation using E-view 10

From Table 4, the result shows that the ECM included in this model has the right sign (i. e. negative) and is statistically significant at 5 percent level. The coefficient indicates an adjustment speed of about 74 percent. This adjustment implies that 74 per cent of errors are corrected within one year since that data were annual series. The ECM also reveals that a long run relationship exists between the regressors (ORV*GOE, ORV*ROQ, ORV*VOA, ORV*COC and ORV*ROL) and the response variable RPI in this model.

Furthermore, the calculated Adj-R^2 is 0.226519. This means that about 23 per cent of the total variations in RPI are caused by the explanatory variables ORV*GOE, ORV*ROQ, ORV*VOA, ORV*COC and ORV*ROL. Thus, the remaining 77 per cent of variations is caused by exogenous factors to the model but covered by the error term. Also, the F-statistics calculated of 2.564284with F-Probability value of 0.043286 is less than 0.05 level. This means that the overall model is significant at 5 per cent level. The value of the D.W is 1.910562 suggests that there is minimal serial autocorrelation in the model.

Table 4 shows that in the short run, the coefficient of ORV*GOE has a positive (0.000631) relationship with RPI, meaning that a unit increase in ORV*GOE increases RPI in Nigeria. This implies that a direct relationship exists between ORV*GOE and RPI. The positive sign of the coefficient of ORV*GOE in the short run conforms to a priori expectation. The coefficient of ORV*GOE is statistically significant with RPI at 5 percent level of significance,

The coefficient of ORV*ROQ has a negative (-0.000774) relationship with RPI, meaning that a unit increase in ORV*ROQ decreases RPI in Nigeria in the short run. This implies that an indirect relationship exists between ORV*ROQ and RPI in Nigeria. The negative sign of the coefficient of ORV*ROQ in the short run does not conform to a priori expectation. The coefficient of ORV*ROQ is not statistically significant with RPI at 5 percent level of significance.

The table also shows that in short run, the coefficient of ORV*VOA has a positive (0.000505) relationship with RPI, meaning that a unit increase in ORV*VOA increases RPI in Nigeria. This implies that a direct relationship exists between ORV*VOA and RPI in Nigeria all things being equal. The positive sign of the coefficient of ORV*VOA in the short run conforms to a priori expectation. The coefficient of ORV*VOA is statistically significant with RPI at 5 percent level of significance.

Again, in the short run, the coefficient of ORV*COC has a positive (0.000002) relationship with RPI, meaning that a unit increase in ORV*COC increases RPI in Nigeria. This implies that a direct relationship exists between ORV*COC and RPI. The positive sign of the coefficient of ORV*COC in the short run conforms to a priori expectation. The coefficient of ORV*COC is statistically significant with RPI at 5 percent level of significance.

The coefficient of ORV*ROL has a negative (-0.001781) relationship with RPI, meaning that a unit increase in ORV*ROL decreases RPI in Nigeria. This implies that an indirect relationship exists between ORV*ROL and RPI in Nigeria. The negative sign of the coefficient of ORV*ROL in the short run does not conform with the a priori expectation. The coefficient of ORV*ROL is not statistically significant with RPI at 5 percent level of significance. The negative effect of ORV*ROL on per capita income (RPI) in Nigeria supports previous studies such as Azam and Emirullah (2014), Deyshappriy (2015), Awan and Mustafa (2015).

Inferences drawn from the short and long run results using the autoregressive distributed lag (ARDL) estimation shows that the interaction between oil revenue and government effectiveness (ORV*GOE) has a stable effect on per capita income (RPI) in Nigeria; the interaction between oil revenue and Regulatory Quality(ORV*ROQ) has a stable effect on per capita income (RPI) in Nigeria; the interaction between Crude oil revenue and Voice & Accountability (ORV*VOA) has a stable effect on per capita income (RPI) in Nigeria; the interaction between oil revenue and Control of Corruption(ORV*COC) has a stable effect on per capita income (RPI) in Nigeria; the interaction between Crude oil revenue and Rule of Law(ORV*ROL) has a stable effect on per capita income (RPI) in Nigeria for the period under study. The negative effect of the interaction between oil revenue and Rule of Law(ORV*ROL) and per capita income (RPI) in Nigeria may be as a result of bad governance that is centralised around the idea of not only corruption within a system but a lack of transparency and accountability, arbitrary policy making and the cheating of those who are governed.

Post Estimation Test for Joint Interaction between Oil Revenue and Governance on Per Capita Income

The researcher also conducted a diagnostic test to ascertain whether or not the series are free from linearity (Ramsey Reset Test), autocorrelation (Breusch-Godfrey Serial Correlation LM Test), heteroscedasticity (Breusch-Pegan-Godfrey Test).

The result of the diagnostic test is presented in Table 5.

Table 5: Serial Correlation LM Test and Homoscedasticity Test Results for Joint Interaction Between Oil Revenue and Governance on Per Capita Income

	F-Statistic	Prob. Value
Breusch-Godfrey Serial Correlation LM Test	1.129375	0.3413
Breusch-Pagan-Godfrey Heteroskedasticity Test	1.147760	0.3660

Source: Author's Computation using E-view 10

From Table 5, the results of the diagnostic test show that the serial or autocorrelation test using Breusch-Godfrey Serial Correlation LM Test, that the f-statistic is 1.129375, and a Chi-Square probability value is 0.3413. This indicates that the probability value of about 34 percent (0.3413) is greater than 5 percent (0.05) critical value; hence we confirm no serial correlation in the model.

The result of the heteroscedasticity test using Breusch-Pegan-Godfrey test shows that the f-statistic is 1.147760 with a Chi-Square probability value of 0.3660. The result suggests that there is no evidence of heteroskedasticity in the model since the probability Chi-square value is more than 5 percent ($p>0.05$). So, residuals do have constant variance which is desirable in regression meaning that residuals are Homoscedastic.

Conclusion

The study concluded that the interaction between oil revenue and government effectiveness increases per capita income in Nigeria both in the short run and long run; The interaction between oil revenue and Regulatory Quality decreases per capita income in Nigeria both in the short run and long run; The interaction between oil revenue and Voice & Accountability increases per capita income in Nigeria both in the short run and long run; The interaction between oil revenue and Control of Corruption increases per capita income in Nigeria both in the short run and long run; The interaction between oil revenue and Rule of Law decreases per capita income in Nigeria both in the short run and long run; The interaction between oil revenue and government effectiveness decreases Life Expectancy in Nigeria both in the short run and long run. The study therefore concludes that oil revenue and governance has both promoted and hindered economic development in Nigeria within the period under review.

Recommendation

The study recommended that there should be there should be accountability and transparency on the part of government and officials in the management of oil revenues for the benefit of the citizens and the economy as a whole.

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