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Autoregressive Evaluation of the Joint Interaction Between Oil Revenue and Governance on Literacy Rate in Nigeria

[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 Evaluated the Joint Interaction between Oil Revenue and Governance on Literacy Rate 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. 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 (0.005575) relationship with LTR, ORV*ROQ has a negative (-0.000725) relationship with LTR, ORV*VOA has a positive (0.001309) relationship with LTR, ORV*COC has a negative (-0.000095) relationship with LTR, ORV*ROL has a negative (-0.001109) relationship with LTR. 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 promoted increased literacy rate in Nigeria within the period under review and recommended a corrupt – free and efficient administrative machinery with adequately trained, well equipped and motivated personnel would enable Nigeria to make appreciable progress in revenue generation.*

Keywords: Crude oil, Governance, Literacy rate

INTRODUCTION

One of the main natural resources in Nigeria is crude oil (Usman, 2007). Crude oil is Nigeria's major natural resource endowment and it is an integral part of national wealth, which enhances a country's potential for economic growth around the world. 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). Governance is important to achieve investment and thus economic growth by creating sound business environment. Governance is defined by United Nations development programme (1997) as "The exercise of economic, political and administrative authority to manage a country's affairs at all levels. For oil revenue to drive the desired economic development, there has to be good governance. Governance according to World Bank is "the manner in which power is exercised in the management of a country's economic and social resources for development.

Over dependence on oil revenue tends to distort and discourage sourcing of funds from other sources by the government, for example as a result of huge oil revenue flows, countries tend to de-emphasize income taxes as a source of government revenue. Besides low tax ratios and high consumption expenditure (typically on imported goods), reinforce inflationary tendencies with regard to expenditure, government pay less or no attention to infrastructural development, encouragement of private sector investment, mechanizing the agricultural and manufacturing sectors of the economy because of the reliance on petroleum revenue.

The aim of the study was to determine the effect of the joint interaction between crude oil revenue and governance on literacy rate 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

LTR=f(ORV*COC, ORV*VOA,ORV*ROQ,ORV*ROL,ORV*GOE)

$LTR_t=\alpha_o+\beta_1 OREV*COC_t+\beta_2$, $ORV*VOA_t+\beta_3 ORV*ROQ_t+\beta_4 ORV*ROL_t+ \beta_5 ORV*GOE_t+ U_t$ Where;

LTR = Literacy Rate

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:

$$\Delta LTR_t = \beta_0 + \Delta LTR_{t-1} + \Sigma\beta_{1t}\Delta ORV*GOE_{t-1} + \Sigma\beta_{2t}\Delta ORV*ROQ_{t-1} + \Sigma\beta_{3t}\Delta ORV*VOA_{t-1} + \Sigma\beta_{4t}\Delta ORV*COC_{t-1} + \Sigma\beta_{5t}\Delta ORV*ROL_{t-1} + LTR_{t-1}\Sigma\Phi_{2t}ORV*GOE_{t-1} + \Sigma\Phi_{3t}ORV*ROQ_{t-1} + \Sigma\Phi_{4t}ORV*VOA_{t-1} + \Sigma\Phi_{4t}ORV*COC_{t-1} + \Sigma\Phi_{4t}ORV*ROL_{t-1} + U_t$$

RESULTS AND DISCUSSION

Time Plot of Literacy Rate Presented in Figure 1

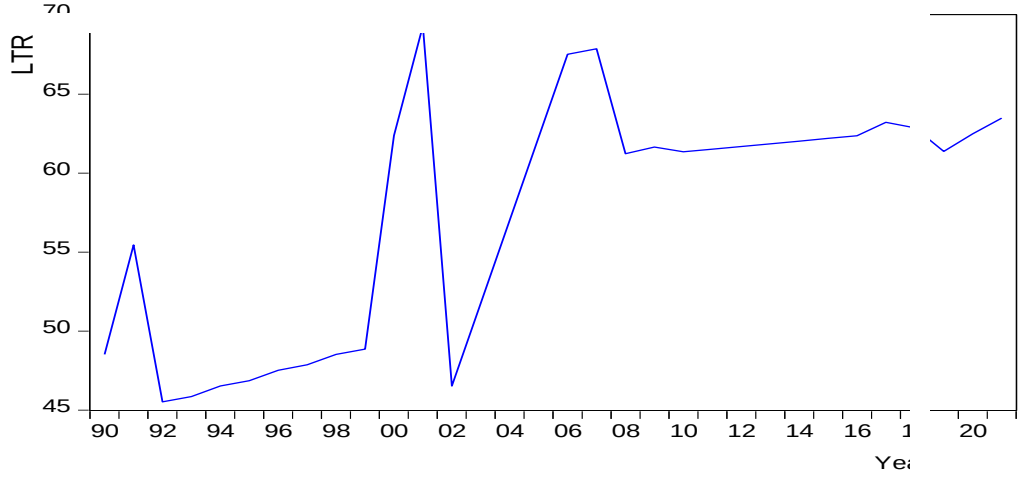

Figure 1: Time Series Plot of Nigeria's LTR (1990-2021)

Figure 1 shows that the values of Nigeria's Literacy Rate (LTR) maintained an increasing trend durir the period chosen for this study. Literacy Rate (LTR) increased from 1990 to 1991 and dropped down to its lowest value in 1992 ıd later went up to its peak in 2000, came down in 2002 and moved up and down to 2006, dropped down again in 2015 and later rose again in 2021.

Unit Root Test for Joint Interaction between Oil Revenue and Governance on Literacy Rate

Table 1 present the results of the stationarity test for each of the variables used in model one 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 Literacy Rate

Variable	ADF at Level	ADF at 1st Difference	Status	Remark
LTR	-2.367456	-6.003327	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 LTR, ORV*VOA, ORV*ROL, ORV*GOE and ORV*ROQ were stationary at 1st difference. Hence, the study then concludes that the independent variables used in model six 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, the appropriate test to use in this study is the Bounds co-integration test.

Bound Test Co-integration Result for Joint Interaction between Oil Revenue and Governance on Literacy Rate

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

Table 2: ARDL Bound Test Co-integration Result for Model Six

Test Statistic	Value	K
F-statistic	5.389546	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 5.389546 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, ORV*GOE and LTR 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 Literacy Rate

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

Table 3: ARDL Long Run Estimation Result for LTR model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ORV*GOE	0.008826	0.008797	1.003329	0.3257
ORV*ROQ	-0.000924	0.000349	-2.647372	0.0183
ORV*VOA	0.002072	0.001995	1.038741	0.3093
ORV*COC	-0.008904	0.004020	-2.214985	0.0369
ORV*ROL	-0.011118	0.009299	-1.195529	0.2436
C	52.563639	2.801394	18.763387	0.0000

Source: Author's Computation using E-view 10

Table 3 shows that in the long run, the coefficient of ORV*GOE has a positive (0.008826) relationship with LTR, meaning that a unit increase in ORV*GOE increases LTR in Nigeria. This implies that a direct relationship exists between ORV*GOE and LTR in Nigeria all things being equal. 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 LTR at 5 percent level of significance.

In the long run, the coefficient of ORV*ROQ has a negative (-0.000924) relationship with RPI, meaning that a unit increase in ORV*ROQ decreases LTR in Nigeria. This implies that an indirect relationship exists between ORV*ROQ and LTR. The negative sign of the coefficient of GOE in the long run does not conform to a-priori expectation. The coefficient of ORV*ROQ is not statistically significant with LTR at 5 percent level of significance.

While the coefficient of ORV*VOA has a positive (0.002072) relationship with RPI, meaning that a unit increase in ORV*VOA increases LTR in Nigeria. This implies that a direct relationship exists between ORV*VOA and LTR in Nigeria. The positive sign of the coefficient of ORV*VOA in the long run conforms to a-priori expectation. The coefficient of ORV*VOAis statistically significant with LTR at 5 percent level of significance.

The table also shows that in long run, the coefficient of ORV*COC has a negative (-0.008904) relationship with LTR, meaning that a unit increase in ORV*COC decreases RPI in Nigeria. This implies that an indirect relationship exists between ORV*COC and LTR in Nigeria all things being equal. The negative sign of the coefficient of ORV*COC in the long run conforms to a-priori expectation. The coefficient of ORV*COC is not statistically significant with LTR at 5 percent level of significance.

Again, in the long run, the coefficient of ORV*ROL has a negative (-0.011118) relationship with LTR, meaning that a unit increase in ORV*ROL decreases LTR in Nigeria. This implies that an indirect relationship exists between ORV*ROL and LTR. The negative sign of the coefficient of ORV*ROL in the long run does not conform with the a priori expectation. The coefficient of ORV*ROL is not statistically significant with LTR at 5 percent level of significance.

Short Run Estimation Results for Joint Interaction between Oil Revenue and Governance on Literacy Rate

The results of the short run dynamics estimation of model six is presented in equation 4.

Table 4: ARDL Short Run Estimation Result for LTR Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ORV*GOE)	0.005575	0.005449	1.023023	0.3165
D(ORV*ROQ)	-0.000725	0.000235	-3.089855	0.0075
D(ORV*VOA)	0.001309	0.001321	0.991012	0.3316
D(ORV*COC)	-0.000095	0.000087	-1.093248	0.2851
D(ORV*ROL)	-0.001109	0.000453	-2.448372	0.0271
ECM (-1)	-0.631602	0.182243	-3.465720	0.0020
Adj-R2 = 0.742034; F-stat. = 15.38240 with F-Prob. = 0.000000; and DW = 2.027875				

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 a low adjustment speed of about 63 percent. This adjustment implies that 63 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 LTR in this model.

Furthermore, the calculated Adj-R^2 is 0.742034. This means that about 74 per cent of the total variations in LTR are caused by the explanatory variables ORV*GOE, ORV*ROQ, ORV*VOA, ORV*COC and ORV*ROL. Thus, the remaining 61 per cent of variations is caused by exogenous factors to the model but covered by the error term. Also, the F-statistics calculated of 15.38240 with F-Probability value of 0.000000 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 2.027875suggests that there is minimal serial autocorrelation in the model six.

Table 3 shows that in the short run, the coefficient of ORV*GOE has a positive (0.005575) relationship with LTR, meaning that a unit increase in ORV*GOE increases LTR in Nigeria. This implies that a direct relationship exists between ORV*GOE and LTR. 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 LTR at 5 percent level of significance.

The coefficient of ORV*ROQ has a negative (-0.000725) relationship with LTR, meaning that a unit increase in ORV*ROQ decreases LTR in Nigeria in the short run. This implies that an indirect relationship exists between ORV*ROQ and LTR 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 LTR at 5 percent level of significance.

The table also shows that in short run, the coefficient of ORV*VOA has a positive (0.001309) relationship with LTR, meaning that a unit increase in ORV*VOA increases LTR in Nigeria. This implies that a direct relationship exists between ORV*VOA and LTR 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 LTR at 5 percent level of significance.

Again, in the short run, the coefficient of ORV*COC has a negative (-0.000095) relationship with LTR, meaning that a unit increase in ORV*COC decreases LTR in Nigeria. This implies that an indirect relationship exists between ORV*COC and LTR. The negative sign of the coefficient of ORV*COC in the short run does not conform to a-priori expectation. The coefficient of ORV*COC is not statistically significant with LTR at 5 percent level of significance.

The coefficient of ORV*ROL has a negative (-0.001109) relationship with LTR, meaning that a unit increase in ORV*ROL decreases LTR in Nigeria. This implies that an indirect relationship exists between ORV*ROL and LTR in Nigeria. The negative sign of the coefficient of ORV*ROL in the short run does not conform to a-priori expectation. The coefficient of ORV*ROL is not statistically significant with LTR at 5 percent level of significance. This negative effect of the combination of oil revenue and the rule of law is different from the findings of Oluwatoyin and Folasade (2014), Hein, *et al* (2014), Liu, et al (2018) that reported a positive relationship between rule of law and literacy rate and Ogunbiyi and Abina (2019) that reported positive relationship between oil revenue and literacy rate.

Inferences drawn from the short and long run results using the autoregressive distributed lag (ARDL) estimation shows that, the interaction between Crude oil revenue and government effectiveness (ORV*GOE) has a stable effect on Literacy Rate (LTR) in Nigeria; the interaction between Crude oil revenue and Regulatory Quality(ORV*ROQ) has a stable effect on Literacy Rate (LTR) in Nigeria; the interaction between oil revenue and Regulatory Quality(ORV*ROQ) does not affects Literacy Rate(LTR) in Nigeria; the interaction between oil revenue and Voice & Accountability (ORV*VOA) has a stable effect on Literacy Rate(LTR) in Nigeria; the interaction between Crude oil revenue and Control of Corruption(ORV*COC) has an unstable effect on Literacy Rate(LTR)in Nigeria; the interaction between oil revenue and Rule of Law(ORV*ROL) has an unstable effect on Literacy Rate(LTR) in Nigeria over the study period.

Post Estimation Test for Joint Interaction between Oil Revenue and Governance on Literacy Rate

The researcher also conducted a diagnostic test to ascertain whether or not the series are free from 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 Literacy Rate

	F-Statistic	Prob. Value
Breusch-Godfrey Serial Correlation LM Test	2.207121	0.1338
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.560737	0.7290

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 shows that the f-statistic is 2.207121, and a Chi-Square probability value is0.7290. This indicates that the probability value of about 13 percent (0.1338) 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 0.560737 with a Chi-Square probability value of 0.7290. 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 Literacy Rate in Nigeria both in the short run and long run; The interaction between oil revenue and Regulatory Quality decreases Literacy Rate in Nigeria both in the short run and long run; The interaction between oil revenue and Voice & Accountability increases Literacy Rate in Nigeria both in the short run and long run; The interaction between oil revenue and Control of Corruption increases Literacy Rate in Nigeria in the short run but causes a reduction in the long run; The interaction between oil revenue and Rule of Law decreases Literacy Rate in Nigeria in the short run but causes an increase in it in the long run. The study therefore concludes that oil revenue and governance has promoted increased literacy rate in Nigeria within the period under review.

Recommendation

The study recommended a corrupt – free and efficient administrative machinery with adequately trained, well equipped and motivated personnel would enable Nigeria to make appreciable progress in revenue generation.

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