

Trade Openness and Solid Mineral Sub-Sector Growth in Nigeria

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Citation: Lakia Nwifa Nwinyodee, and Timothy Kabari Kerebana (2022) Trade Openness and Solid Mineral Sub-Sector Growth in Nigeria, *International Journal of Development and Economic Sustainability*, Vol.10, No.4, pp.26-36

ABSTRACT: *Government at different times had implemented policies and programs to trigger the performance of the solid mineral sub-sector in Nigeria positively yet its contribution to the GDP remains dismal. Hence, the study focused on the impact of trade openness on the growth of solid mineral Sub-sector in Nigeria from 1981 to 2020. The study employed Auto Regressive Distributed Lag (ARDL) as the modeling technique. Solid mineral subsector (SLM) was used as the dependent variable while Trade openness (TPN), Foreign direct investment (FDI), Foreign portfolio investment (PFI), Remittances (RMT) constituted the independent variables. Exchange rate (EXR) was used as check variable. The study found that TPN, FPI, RMT and EXR negatively influenced the solid mineral sub-sector. FDI maintained a positive relationship with SLM. Based on these findings, the paper recommended that government should extend the tax exemption period for companies exploiting solid minerals beyond the existing three years to attract foreign investors into the sub-sector. Also, government should adequately regulate the mining sub-sector to attract portfolio investment and foreign remittances into the sector.*

KEY WORDS: trade openness, solid mineral , growth

INTRODUCTION

The gradual shift of global economic emphasis from oil to other sources of energy and the quest for the diversification of the revenue base of any economy have deepened the emphasis on the solid mineral sub-sector. Nigeria is copiously endowed with vast minerals reserves ranging from coal, uranium, lead, zinc, tin, aluminum, copper thorium, iron manganese, chromium and limestone etc. Most of these have not been exploited for the economic benefit of the nation because of the over dependence on the petroleum sector (Maduaka, 2014). Prior to crude oil windfall of the 1970s and the 1980s, solid mineral contributed hugely to the national output of Nigeria. Earnings from the sub-sector were used to boost infrastructural amenities and develop other sectors of the economy including the petroleum industry. Arguably, the performance of the sub-sector declined faster with increased attention on crude oil.

Ajie, Okoh & Ojiya, (2019) asserted that if the solid mineral sub-sector is adequately developed could sufficiently salvage the nation from economic recession occasioned by oil price shock. The sector has the potential to entrench inclusive development because it's huge revenue and employment potential. Realizing the indispensability of the sector and the quest to diversify and broaden the fiscal space of the nation. Successive governments in Nigeria have taken measures aimed at developing the sub-sector. Some of these includes National Council for Mining and Mineral Resources Development (NCMMRD) in 2017, minerals and mining act of 2007, minerals and mining regulations of 2011, the presidential retreat on solid minerals August 2013 (Omoh et al, 2015). However, these efforts have only led to a minuscule growth in the sector; with the sector's contributions to the Nation's Gross Domestic Product (GDP) remaining at less than 1percent from 2004 to 2017. The contribution of the sector is grossly insignificant. CBN statistical bulletin 2018 established that the contribution of solid mineral grew marginally from 0.09 percent in 2011 to 0.11 in 2017. However, studies have been conducted on solid mineral in Nigeria (Ajie et al., 2019, Mbah and Magbemena, 2019 and Adenugba and Dipo, 2013), but none of them examined the influence of trade openness on solid mineral subsector growth in Nigeria.

Theoretical Review

The Grosman and Helpman growth model form the main theoretical base of the study. The model was developed by Grossman and Helpman, (1991). The model opines that trade openness impacts rate of growth in the long-run which may transit into improved social welfare and a steady state. The theory also assumed that new knowledge and discoveries which is cardinal for economic growth is gained when people in the small society communicate with agents in the world outside. One of the proponents of the theory is Romer (1992) who argued that knowledge gained from contact with international gents increases the volume of bilateral trade. Openness results to increase in growth and stock of knowledge since producers are exposed to more productive ideas (Melitz and Redding, 2021) On the other hand, Lau and Wan (1994) argued that trade is necessary but not sufficient for poorer and middle-income economies because they cannot accumulate the benefits of openness since costs of production will decline with increase growth. Thus, these countries will experience a widening income gap. The study adopts the Grosman and Helpman growth model because of its emphasis on trade, innovation and technology as a product of interaction between local knowledge and foreign ideas. Mathematical the model can be specified thus:

$$K(t) = f [n(t), T(t)] \quad (1)$$

Where:

K = Capital stock of knowledge in view of the alternative source of knowledge

T (t) = Cumulative volume of trade (export plus import) up time t.

n (t) = Increase in available varieties (domestic research)

f = Increase in both arguments and homogeneous of degree one.

Empirical Review

Adewunmi and Arije (2019) evaluated the impact of Foreign Direct Investment on Solid Minerals Industry in Nigeria for the period covering 1992 to 2016 using the Ordinary Least Square (OLS) method. The study showed that foreign direct investment (FDI) positively impacted the Solid Minerals and contributed to gross Domestic Product.

Ajie et al. (2019) investigated the impact of solid mineral resources on economic growth in Nigeria from 1981- 2015 using ordinary least squares (OLS). The results of the study indicated that the contributions of the solid mineral sector were negligible but commendable because it has been sidelined by successive administrations in Nigeria. The study recommended that because of the importance of the solid minerals sector as part of the federal government policy on diversifying the economy from over-dependence on oil revenue, the government should formulate an explicit export-promotion programme based on principles of comparative advantage to encourage the growth of the sector. The government should encourage private investment, both local and foreign, through adequate provision of infrastructures, and encouragement of macroeconomic stability.

Mbah and Magbemena (2019) Analyzed Investments (domestic and foreign direct investments) And Solid Mineral Development from 1981-2016 using a multivariate vector autoregressive (VAR) model and ADF test of unit root, autoregressive distributed lag cointegration test and Vector Error Correction Mechanism (VECM). The results of the VAR estimation indicated that there was no relationship between domestic investment and solid mineral development in Nigeria while foreign direct investment is positively related to solid mineral development; it has not significantly driven solid mineral development within the period under study. Foreign portfolio investment exercised a negative impact on solid mineral development in Nigeria. The study recommended that the government should introduce measures that will improve the contribution of domestic investment to the solid mineral sector of Nigeria.

Vincent (2017) assessed the impact of then on-oil exports to the growth of the Nigerian economy using annual data from 1980 to 2016. The study employed Phillip Perron (PP) test, the Engel-Granger Model (EGM) for co-integration. The findings of the study revealed strong evidence of the co-integration relationship of non-oil exports influences economic growth in Nigeria. The study recommended economic diversification.

Ogunjimi et al. (2015) analyzed the relationship between the non-oil sector and economic growth from 1980-2012 using the ordinary least square (OLS) approach. The result of the study showed that Oil export was not significant. That is, the export of crude oil does not impact economic growth positively in Nigeria. The study observed that finished product influences more price than that of crude oil export. From the foregoing, the study recommended that there it is essential for both the non-oil and oil exports to be repositioned through ensuring that the economy exports finished products as opposed to the export of crude oil and raw products.

Adenugba and Dipo (2013) investigated the effectiveness of Nigeria's export promotion strategies in diversifying the productive base of the Nigerian Economy from Crude oil as the major source of foreign exchange from 1981 to 2010, using the ordinary least squares (OLS) method. Findings of the study showed that non –oil exports have performed weakly in the period under review.

Adeniyi et al. (2013) surveyed the relationship between solid minerals and economic growth in Nigeria, employing mainly qualitative analysis. The study exposed that the solid mineral sector remains critical to economic development, wealth creation and poverty alleviation in any nation that is blessed with such mineral deposits and thus concluded that Nigeria government should adopt best practices and mechanisms that have been used by different countries to formalize and regulate mining explorations to attain sustainable development in the mining sector in Nigeria.

Akongwale et al. (2013) examined the role of solid minerals in economic diversification in Nigeria, using both qualitative and quantitative (descriptive) analysis, the study indicated that the solid mineral sector in Nigeria has the potential to enormously contribute to the economy of Nigeria. It equally reveals that the development of the solid mineral sector could help to combat poverty in Nigeria via job creation; especially, given its forward linkage with other sectors of the economy. Most importantly, it could help alleviate some of the problems associated with the enclave nature of the Nigerian economy that has for too long been vulnerable to fluctuations in global oil prices.

Butkiewicz and Yanikkaya (2010) employed panel data to examine minerals, institutions, openness, the findings showed that mineral resources use weak institutions and openness to trade to stifle the development of human capital, to the detriment of growth in other sectors of the economy. Manufacturing imports substitute for the development of domestic production, trade openness correlates with lower growth in mineral dependent economies.

Observable Gaps in Literature

The relevant literature reviewed which includes Mbah & Magbemena (2019), Adewunmi and Arije (2019) and Vincent (2017) among others revealed that no previous study have been conducted on trade openness and solid mineral subsector growth in Nigeria.

Methodology

The study adopted the ex-post facto research design which is a component of the quasi-experimental research design. Data used were time series data sourced from CBN statistical bulletin of various years and World Bank data. The study adopted ADF unit root test, Auto Regressive Distributed Lag (ARDL) and finally carried out some diagnostic test.

Model specification

$$SLM = f(TPN, FDI, FPI, RMT, EXR) \quad (1)$$

Where;

SLM = Output of Solid Mineral Industry

TPN = Trade Openness

FDI= Foreign Direct Investment
 FPI= Foreign Portfolio Investment
 RMT= Foreign Remittances
 EXR = Exchange Rate

The explicit econometric forms of equation 1 above can be stated as follows:

$$SLM = \phi_0 + \phi_1 TPN + \phi_2 FDI + \phi_3 FPI + \phi_4 RMT + \phi_5 EXR + \mu_t \quad (2)$$

Where;

ϕ_0 = Intercept
 $\phi_1 - \phi_5$ = Coefficients and
 μ = Error term

On a priori:

$\phi_1 > 0$, $\phi_2 > 0$, $\phi_3 > 0$ $\phi_4 < 0$ and $\phi_5 < 0$

Table 1: Descriptive Statistic

	<i>SLM</i>	<i>TPN</i>	<i>FDI</i>	<i>FPI</i>	<i>RMT</i>	<i>EXR</i>
Mean	39.63542	32.02935	1.533238	-436.3492	2.670083	98.83096
Median	9.133011	33.38961	1.129237	-3.483000	1.645826	106.4643
Maximum	224.7905	53.27796	5.790847	403.3410	8.311897	306.0837
Minimum	3.715748	9.135846	0.257422	-3840.685	0.004883	0.617708
Std. Dev.	53.83524	12.28184	1.222741	972.1558	2.600845	96.26770
Skewness	1.752047	-0.305390	1.781342	-2.184833	0.491286	0.746820
Kurtosis	5.439289	2.250473	6.240151	6.571982	1.791111	2.600477
Jarque-Bera	30.38134	1.558073	38.65217	53.08838	4.044771	3.984294
Probability	0.000000	0.458848	0.000000	0.000000	0.132339	0.136402
Sum	1585.417	1281.174	61.32953	-17453.97	106.8033	3953.239
Sum Sq. Dev.	113031.1	5882.905	58.30873	36858387	263.8114	361431.3
Observation	40	40	40	40	40	40

Source: *Author's Computation using E-views 9*

From the descriptive statistics result above, SLM, TPN, FDI, FPI, RMT and EXR have the following mean values: 39.63542, 32.02935, 1.533238, -436.3492, 2.670083 and 98.83096 respectively.

SLM, RMT and EXR were positively skewed while TPN and FPI were negatively skewed with skewness values of -0.353563 and -2.887760 respectively. Again SLM, FDI and FPI were leptokurtic. TPN, RMT and EXR variables were platykurtic, meaning that their distributions were flat relative to normal distribution. The Jarque-Bera statistics and its probability value at 5 percent significant level portrayed that the variables were not normally distributed. Hence, the study conducted the Augmented Dickey Fuller (ADF) unit root tests to determine the level of integration.

Unit Root Test

Table 2 below presents the results of the stationarity test for each of the variables used in the study using the Augmented Dickey Fuller (ADF) test.

Table 2: *ADF Result for Solid Mineral Model*

Variable	ADF at Level	ADF at Difference	1 st Status	Remark
SLM	1.419262	-5.671312	I(1)	Stationary
TPN	-2.276833	-7.347059	I(1)	Stationary
FDI	-3.895169	-	I(0)	Stationary
FPI	-3.418566	-	I(0)	Stationary
RMT	-1.404193	-6.282245	I(1)	Stationary
EXR	1.736109	-4.212040	I(1)	Stationary
<i>Critical Values</i>				
1% level	-3.621023	-3.632900		
5% level	-2.943427	-2.948404		
10% level	-2.610263	-2.612874		

Source: *Author's Computation using E-view 9*

Bound Test Co-integration

The result of the Bound Co-integration test is presented in Table 4.13 below.

Table 3: *ARDL Bound Test Co-integration Result for SLM, TPN, FDI, FPI, RMT, and EXR*

F-Statistics	3.086402	
% Critical Levels	Critical Value for Bond Test	
Significance	I(0) Bond	I(1) Bond
10%	2.26	3.35
5%	2.62	3.79
2.5%	3.96	4.18
1%	3.41	4.68

Source: *Author's Computation using E-views 9*

From Table 3, the result of the bound co-integration test shows that the calculated f-statistic value of 3.086402 falls between the lower and the higher bound I (1) bound at 5 percent. This means that the result is inconclusive. Hence, we now proceed to estimate the short run dynamics based on the ARDL approach.

Short Run Estimation

The results of the short run dynamics estimation of model three (Solid Mineral Model) is presented in table 4.14 below.

Table 4: *Short Run Results*

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(TPN)	-0.001631	0.003602	-0.452708	0.6544
D(FDI)	0.006756	0.036481	0.185195	0.8545
D(FPI)	-0.000031	0.000065	-0.476653	0.6374
D(RMT)	-0.006036	0.035228	-0.171332	0.8652
D(EXR)	-0.001234	0.002306	-0.535364	0.5968
ECM (-1)	-0.234395	0.087615	-2.675277	0.0125
$R^2 = 0.412$; $\text{Adj-}R^2 = 0.216$; F-stat. = 5.1069; DW = 1.651				

Source: *Author's Computation using E-views 9*

The result in table 4 shows that the ECM is rightly signed and statistically significant at 5 percent level and equally revealed that a long run relationship existed between the regressors (TPN, FDI, FPI, RMT, and EXR) and the response variable (SLM) in this model. The result shows that the $\text{Adj-}R^2$ is 0.216 which implies that about 22 per cent of the total variations in SLM are caused for by the explanatory variables. Thus, the remaining 78 per cent of variations is explained by exogenous factors. Also, the f-statistic calculated of 5.1069 is greater than $F_{0.05, V1, \text{ and } V2}$ of 2.42. This means that the overall model is significant at 5 per cent level. The Durbin Watson value of 1.651 suggested the absence of serial autocorrelation in the model.

The result of the above indicates that the coefficient of trade openness is -0.001631; implies that a unit increase in trade openness will decrease solid mineral by about 0.16 percent in Nigeria. The negative sign of trade openness does not conform to our a priori expectation that an increase in trade openness will increase solid mineral.

The coefficient of trade openness is not statistically significant at 5 percent level. Hence, the study, accepts the null hypothesis that there is no significant relationship between trade openness and solid mineral in Nigeria within the period studied. This result economically connotes that TPN did not contribute to the increase in the productivity of solid mineral subsector during the period of investigation. This may be attributed to the inability of government to adequately liberalize the sector.

The FDI result of 0.006756 implies that a unit increase in FDI will stimulate a growth of about 0.68 percent in solid mineral and it is in line with a priori expectation though not statistically significant at 5 percent level. This result corroborates the finding of Adewumi and Arijie (2019).

Similarly, the result of the short-run analysis reveals that the coefficient of FPI is -0.000031 which indicates that a unit increase in foreign portfolio investment will decrease the solid mineral industry by about 0.003 percent in Nigeria. This result does not conform to a priori expectation and is not in line with economic theory. The coefficient of foreign portfolio investment (FPI) is not statistically significant at 5 percent level. It is expected that foreign portfolio investment (FPI) should have significantly improve the solid mineral subsector but the result of the study shows the opposite.

The result of RMT which is -0.006036 implies that a unit increase in RMT will cause a reduction in solid mineral by about 0.603 percent in Nigeria. The negative sign of remittances confirmed that the result does not conform to a priori expectation. RTM is not statistically significant at 5 percent. This study shows that foreign remittances manifested an undesirable effect on the solid mineral subsector during the period under consideration. This may be accredited to the fact that most foreign remittances into Nigeria is not channeled into the solid mineral sector.

The coefficient of exchange rate is statistically significant at the 5 percent level which confirmed that EXR plays a significant role in SLM output in Nigeria during the period of study.

Diagnostic Testing

The study conducted a diagnostic test to ascertain whether or not the series were free from linearity, serial correlation and heteroscedasticity. See table 5 below for details.

Table 5: Ramsey Reset Test, Serial Correlation LM Test and Homoscedasticity Test Results

	F-Statistic	t-Statistic	Obs*R-Square	Prob. Value
Ramsey Reset Test	1.077745	1.038145	-	0.3088
Breusch-Godfrey Serial Correlation LM Test	0.550283	-	0.766864	0.4649
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.764216	-	7.511787	0.6494

Source: Author's Computation using E-view 9

From table 5 above, the results of the diagnostic test shows that the linearity test using Ramsey reset test indicates an f-statistic value of 1.077745, t-statistic value of 1.038145 and a probability value of 0.3088 which is greater than 5 percent critical value. Thus the study rejected the null hypothesis and concluded that the model was correctly specified. Similarly, the result of the serial correlation LM test shows a probability value of 0.4649 which is not significant at 5 percent which confirms the absence of serial correlation in the model. Finally, the result of the heteroscedasticity

test indicates a probability value of 0.6494 which equally revealed that there is no evidence of heteroskedasticity in the model

Normality Test

The normality result revealed a probability value of about 27 percent (0.268825) which is higher than the 5 percent (0.05) which confirm that the model was normally distributed. See figure one for detailed result.

Figure 1: Jarque-Bera Normality Test.

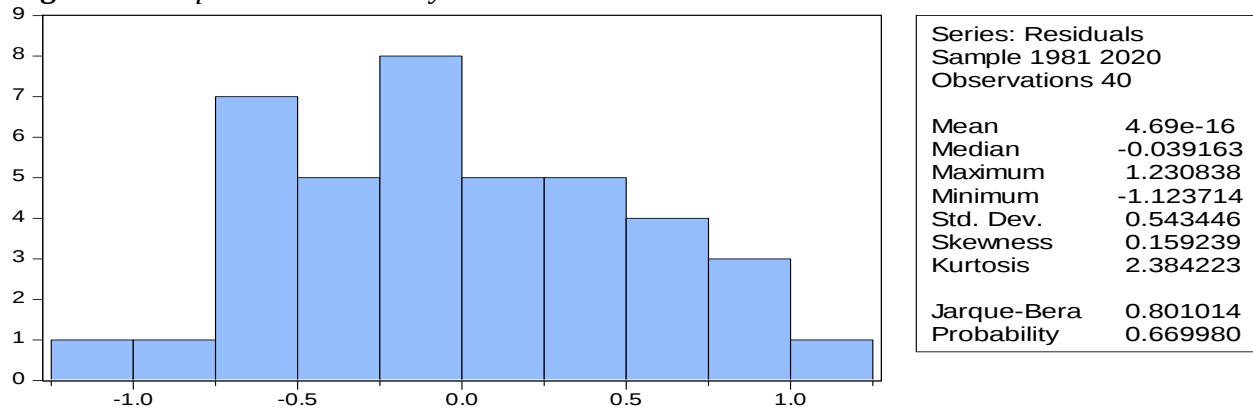
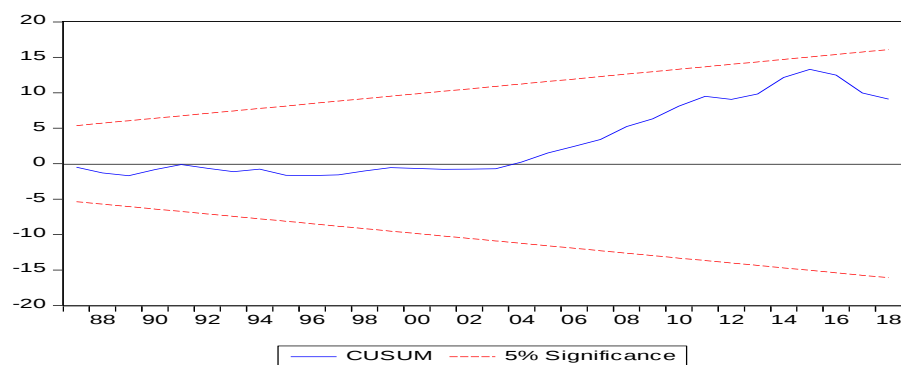


Figure 2: CUSUM Residuals Graph



Parameter Stability Test

The cumulative sum of recursive residuals (CUSUM) was employed to examine if there were any major policy changes in the series. However, from the residual graph above, there was no policy shock in the model implying stability.

Conclusion and Recommendations

The study focused on the impact of trade openness on the growth of solid mineral Sub-sector in Nigeria from 1981 to 2020. The study engaged solid mineral subsector as the dependent variable

while Trade openness, foreign direct investment, foreign portfolio investment, remittances were the independent variables and exchange rate check variable. The paper first initiated descriptive statistics and the Augmented Dickey Fuller (ADF) unit root test to ascertain the stationarity of the variables in the series. The bound co-integration test was conducted and the result was inconclusive. Hence, the study estimated the short run dynamics based on the ARDL approach.

The paper found that trade openness, portfolio investment, foreign remittances and exchange rate negatively influenced the performance of the solid mineral sub-sector in Nigeria during the period of study while foreign direct investment exhibited a positive relationship with sector. Based on these findings, the paper recommended that government should extend the tax exemption period for companies exploiting solid minerals beyond the existing three years to attract foreign investors into the sub-sector. Also, government should adequately regulate the mining sub-sector to lure portfolio investment and foreign remittances into the sub-sector.

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