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Manufacturing Sector Performance and Natural Resources Endowment: Evidence from Natural Resource-rich Sub-Saharan African Countries

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Abstract :

Theoretically, it has been observed that an abundance of natural resources that are not well harnessed can displace some vital sectors of the economy, especially the manufacturing sector. In this study, using annual series ranging from 1990-2019 and under the framework of a Panel ARDL, we investigated the link between natural resources endowment and the performance of the manufacturing sector in natural resource-rich SSA countries. Findings of our study show that in the short-run, natural resources endowment has an insignificant positive link with the manufacturing sector performance. However, in the long-run, the contribution of natural resources to the performance of the manufacturing sector becomes negative. On grounds of these findings, we recommend, among others; the diversification of the economies of this group into manufacturing sector by using proceeds from the export of natural resources to develop infrastructure necessary to improve the sector.

Keywords **:** *Natural resources, Manufacturing sector, Institutions, Panel ARDL, Employment, Inflation*

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1. Introduction

Natural resource endowments, if well managed should assist countries endowed with them to grow their economies and hence, get out of the poverty trap. However, experiences have shown that the existence of natural resource endowments turns out to be more of a curse for most countries that have them in abundance, than a blessing. Alpha and Ding (2016) observed that even though theories and general thinking imply that huge revenues from natural resources ought to generate wealth, lead to economic growth and poverty reduction; empirical studies show mixed and conflicting results. Accordingly, existing empirical results indicate the existence of huge natural resources as a blessing and also as a curse to countries that have them. Supporting this claim, Sachs and Warner (2001), tracing the historical paradox of natural resource endowments, observed that in nineteenth and eighteenth centuries, less natural resource endowed countries such as Japan and Switzerland overtook Russia in terms of economic performance despite the fact that Russia is richly endowed with natural resources. In a related vein, the paper further noted that in the past thirty years, while resource-poor countries in East Asia such as Korea, Taiwan, Singapore and Hong Kong were performing better, resource-rich countries such as Nigeria, Venezuela and Mexico had already gone bankrupt.

On the African continent, many countries are richly endowed with natural resources. As such, one would have expected the continent to perform better in relation to other regions of the world. However, the level of poverty, unemployment and other socio-economic misery indicators are very high on the continent. Compared to some oil-rich countries like Norway that have attained reasonable standard of living, Africa's natural resource endowed countries have been lagging behind. Using the Sub-Saharan African (SSA) countries as example, rich natural resource endowed countries within this sub-region are still wallowing in underdevelopment. These countries are still rigidly stuck to the traditional natural resource as the base of their economies without efforts to diversify into the modern sector such as the manufacturing sector. With the exception of mainly two countries in this sub-group, namely: South Africa and Nigeria that have advanced, albeit on a low scale; in the development of the manufacturing sector, the economies of others are still propelled by the proceeds from natural resources. Worst still, the nature of the manufacturing sector development in these countries is dependent on the manufacture of light consumer goods that are usually uncompetitive at the international market.

South Africa is highly endowed with a variety of minerals such as diamonds, coal, gold, iron ore, platinum, manganese, chromium, copper, uranium, silver, beryllium, and titanium. She also has some natural gas deposits that is yet to be developed into commercial quantity. Even with her advance in manufacturing, her economy still depends to a large extent on mining of minerals and gold remains the most important mineral just as she is the world's largest producer of platinum and chromium. With a manufacturing sector that depends heavily on foreign capital, the manufacturing sector still composed of food processing, the production of textiles, metals, and chemicals. The petroleum sector dominates Nigeria's economy with export representing around 86 per cent of total export revenue. Other natural resources also abound in the country such as gas, tin, iron ore, coal, limestone, niobium, lead, zinc and arable land. Diversifying the economy into manufacturing has always been a key objective of the government over the years and this led to the indigenization decree of the seventies and the federal government's establishing of some capital-intensive industries such as steel mills, pulp and paper mills, petrochemical plants and an aluminum smelter. However, due to policy inconsistencies and neglect of these industries which were meant to produce feeder stock to the manufacturing sector, most of them have collapsed. The greatest weakness of

manufacturing sector has been high cost of production and exchange rate constraint owing to over reliance on imported raw materials.

Other natural resource-rich countries in SSA countries featured in our study are: Sierra Leone, Democratic Republic of Congo (DRC), Mauritania and Botswana. There is nothing spectacular about the profile of their manufacturing sector in terms of its development. With regard to mineral resources, Sierra Leone is naturally endowed with diamonds, gold, iron ore, bauxite, titanium ore and chromite. The main source of earning is the mining of Alluvial diamond which accounts for a larger share of her exports. In terms of employment, mining employs a high segment of the population and contributes more to national income. With a huge forest reserve, the DRC is regarded as one of the world's biggest in this regard, in addition to fertile soil and ample rainfall. Among her major minerals include diamonds, gold, copper, cobalt, cassiterite (tin ore) and coltan, as well as timber, coffee and oil. However, what is observable in DRC is that mining activities is concentrated in the hands of artisanal miners. Mauritania has rich deposits of iron ore, gold, gypsum, copper as well as phosphates, zinc, uranium and rare earths. Most Mauritanians engage in traditional activities such as rearing of livestock; particularly goats, sheep, cattle and camels. Botswana is richly endowed with Nickel and copper. Other major proven mineral resources are salt, soda ash and coal.

Despite the abundance of these natural resources, SSA natural resource-rich countries are yet to diversify their economies, especially diversifying into the manufacturing sector. Empirical investigation into the link between natural resource endowments and the performance of the manufacturing sector within SSA natural resource-rich countries therefore forms the objective of this study. This study is paramount as it departs from other studies that concentrate on the nexus between natural resources endowment and economic growth. Our interest in the manufacturing sector is to check the contribution of natural resources to the performance of the manufacturing sector and through this, the theoretical postulation of the crowding-out effect of natural resources endowment on the manufacturing sector can be investigated.

Stylized Facts on Selected Sub-Saharan African Natural Resources-rich Countries

In this sub-section, we use trend analysis to explain the behavior of some relevant variables in the selected countries of our study. Figure i below shows that the trend in the manufacturing value added has been flat for the two most industrialized countries within the sampled SSA countries, namely: South Africa and Nigeria. Botswana which comes third in terms of high manufacturing value added has been experiencing fluctuation in this index over the years. It achieved a peak in the index around 2011 and thereafter the trend became flat. From 2017, Mauritania experienced a rise in the trend which became flat up till 2019, while the trend for Congo Democratic Republic was flat all through the sample period. Sierra Leone which came last in the trend analysis exhibited fluctuations all through the sample period. What this analysis portends is that the performance of the manufacturing sector in the selected SSA countries has been experiencing hiccups without a sustained growth part. This scenario therefore calls for adequate policy measures to be put in place.

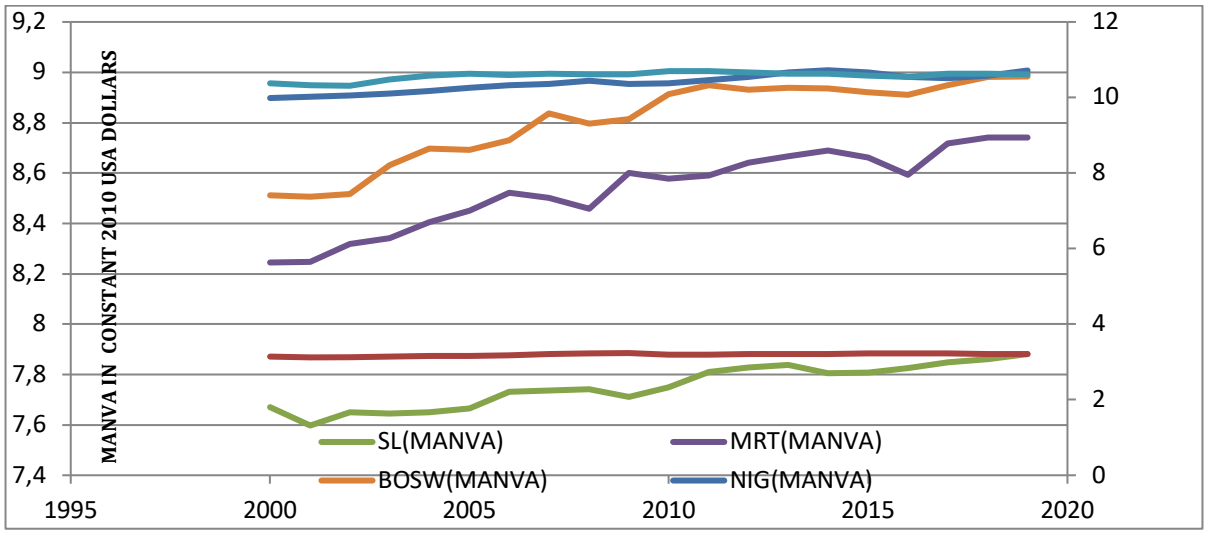

Figure 1. Trend in manufacturing value added (MANVA) in SSA natural resources-rich countries

Source: Authors' compilation

Rising interest rate is a major phenomenon that hampers the growth of the manufacturing sector in most of the developing countries which the countries in our study belong. In figure ii below, the countries with the highest interest rate within the sample period are Sierra Leone, Congo Democratic Republic and Mauritania. Not surprisingly, the result of the trend analysis of the manufacturing value added of these countries exhibited lower trend compare to South Africa, Nigeria and Botswana that have lower interest rates relatively. This goes to show the depressing impact of higher interest rate on the manufacturing sector performance.

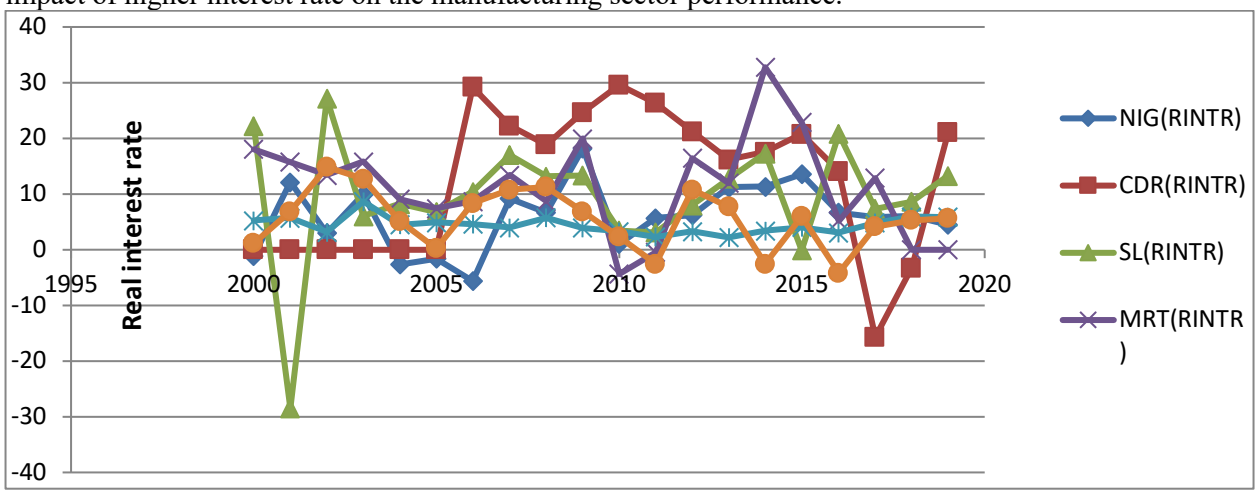

Figure 2. Trend in interest rate in the Sampled SSA countries

Source: Authors' compilation

Another variable that influences the manufacturing sector is inflation rate as it increases the cost of inputs and hence, makes export of manufacture to be uncompetitive. Figure iii below shows that among the countries that have a relatively high inflation rate within the sample period are Sierra Leone, Nigeria and Mauritania. Apart from Nigeria which has a relatively high manufacturing value

added, the other two countries have lower manufacturing value added. South Africa which enjoys the highest manufacturing value added has the lowest rate of inflation among the selected countries. We are of the view that the low interest rate and inflation rate in South Africa could be among the reasons her manufacturing sector performs better. As the manufacturing sector in these countries depend mostly on imported raw materials, rising inflation leads to increased cost of production which makes the export of manufacture in these countries to be uncompetitive at the international market.

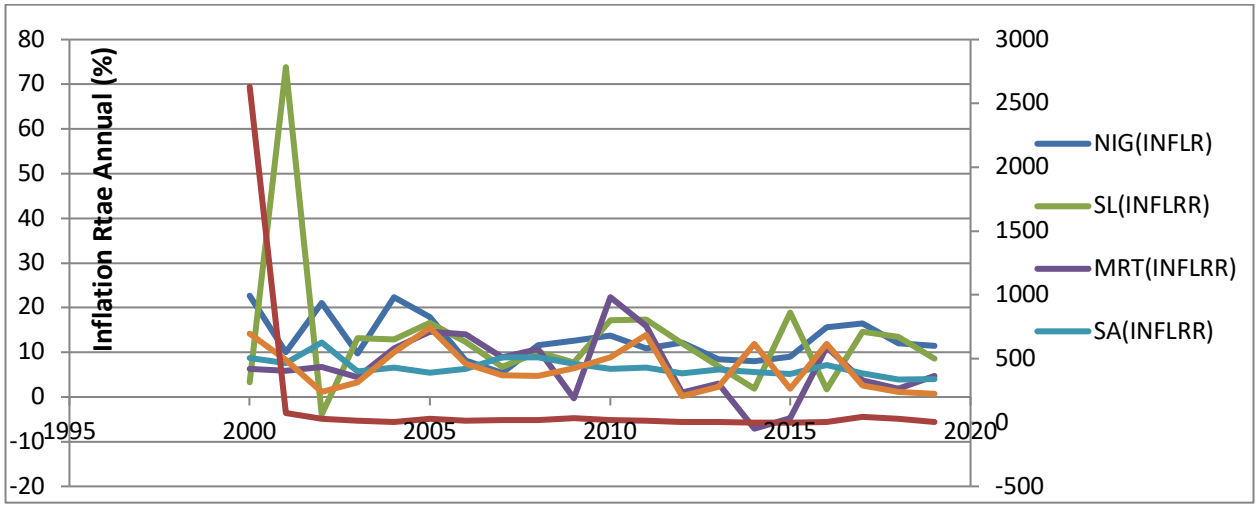

Figure 3. Trend of Inflation Rate in the Sample SSA countries
Source: Authors' compilation

We also analyzed the trend of gross fixed capital formation in these countries. We are interested in this particular analysis to find out if accumulation of capital inputs over a period of time has a bearing on the manufacturing sector performance. From figure iv below, we find that Mauritania experiences a rising trend in her gross fixed capital formation followed by Botswana. Evidence show that the least are Nigeria and South Africa. However, in terms of manufacturing value added, the top three performers, namely; South Africa, Nigeria and Botswana are hardly the countries with the highest growth in gross fixed capital formation. This goes to show that the accumulation of large capital inputs is not a guarantee for sound performance of the manufacturing sector unless the capacity of these inputs is adequately utilized.

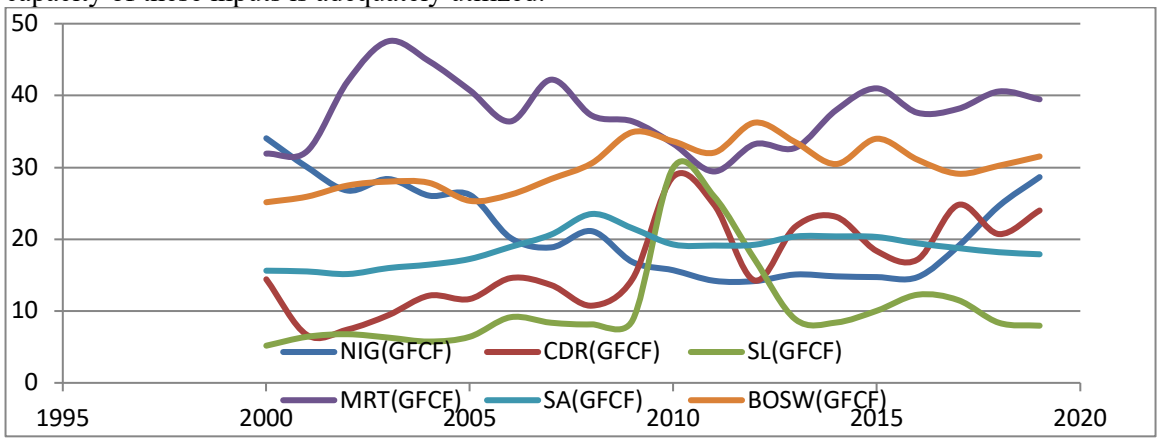

Figure 4. Trend in Gross Fixed Capital Formation
Source: Authors' compilation

We selected some countries with the sub-group based on data availability and carried out a trend analysis on the export of their manufacture. As shown in figure v below, of the four countries selected from the group, Botswana topped the list in terms of export of manufacture and this is followed by South Africa. Mauritania came last in the group as the trend in her export of manufacture was flat all through the sample period. Coincidentally, of the four countries selected with respect to this analysis, Mauritania performs poorly in her manufacturing valued added. Even Nigeria that came second in the trend of manufacturing value added was lower than Botswana in export of manufacture. Perhaps high cost of production and some other constraints could account for reasons why export of manufacture in Nigeria is low.

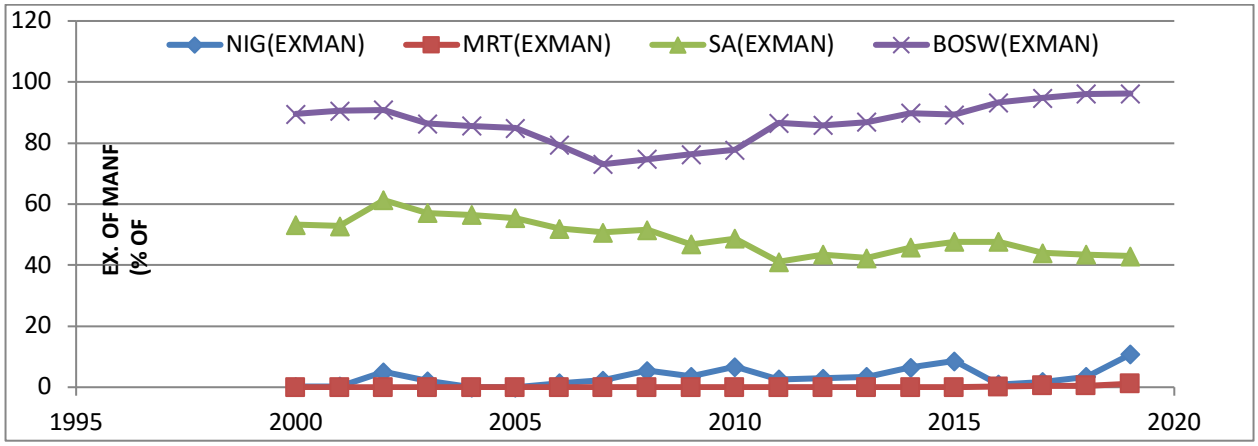

Figure 5. Trend of Export of Manufacture
Source: Authors' compilation

We analyzed comparatively, the receipt of natural resources rent among the selected countries in our study. From figure vi below, it can be found that the two countries with highest receipt from natural resources rent are Congo Democratic Republic and Mauritania and this is followed by Nigeria. The least recipient of natural resources rent are South Africa and Botswana. Evidence from figures i and iv above shows that both South Africa and Botswana perform better in manufacturing value added and export of manufacture. However, the two highest recipients of natural resources rent, namely: Congo Democratic Republic and Mauritania did not perform better in manufacturing value added. This gives us a glimpse of the crowding-out effect of abundance natural resources over the manufacturing sector. Huge receipt of natural resources rent discourages the diversification of the recipient country's economy and the sector that usually suffers most is the manufacturing sector owing to many factors among which is exchange rate appreciation which hampers the export of manufacture.

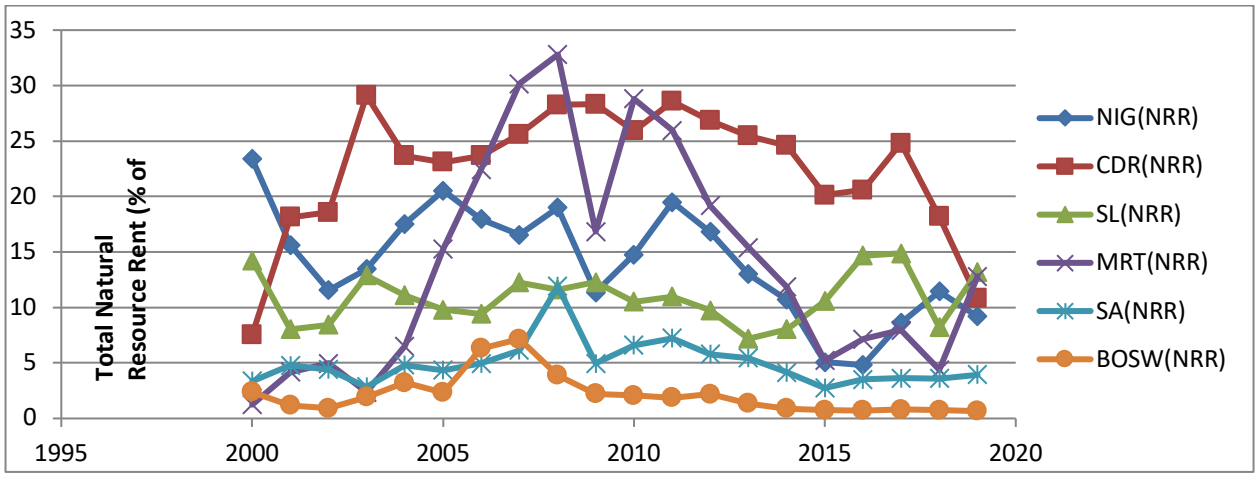

Figure 6. Trend of Natural Resources Rent
Source: Authors' compilation

In terms of GDP growth rate, figure vii below shows that in 2002, Sierra Leone topped the list followed by Nigeria. However, in 2006 Mauritania had the highest growth in GDP and in 2013 Sierra Leone was ahead of other countries sampled. Surprisingly, South Africa lags behind in the growth rate of GDP within the sample period. Sierra Leone and Mauritania fall among the biggest natural resource rent recipient countries and their manufacturing value added is not high. In 2002 and 2013, Sierra Leone experienced a peak in her growth rate of GDP in each of the years which declined sharply thereafter. Also in 2006 Mauritania experienced a peak in her GDP growth rate that sharply declines afterwards. Consequently, we contend that the GDP growth rate in these two countries is spurred by revenue from natural resources which is volatile. The result for South Africa and Botswana that have high manufacturing value added and export of manufacture are evidence that manufacturing sector performance in Sub- Saharan Africa is not strong enough to support a sustained growth rate of GDP

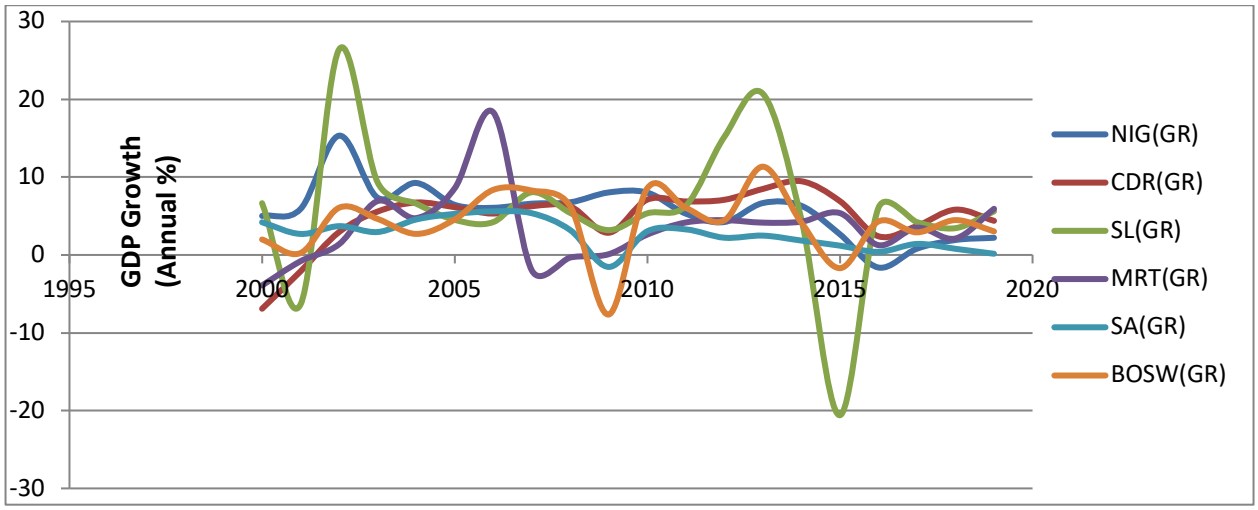

Figure 7. Trend in the Growth Rate in the Selected Countries
Source: Authors' compilation

2. Theoretical Background

Theoretical Issues Arising from Natural Resources Endowment

Several theoretical views have been advanced to explain the impact of natural resources endowment on the economy of countries that have them in abundance. For instance, it has been observed that the existence of abundant natural resources has the tendency to crowd-out the manufacturing sector. In their view, Sachs and Warner (2001) noted that the existence of natural resources abundance could result into a curse if these resources tend to crowd out some vital sectors of the economy such as the manufacturing sector. If an undue attention is accorded to a dominant natural resource sector, such has the tendency to crowd-out the traded-manufacturing industries which can permanently stunt the economy. With huge revenue coming from the dominant natural resources sector, spending profile in these countries is very high and such raises the demand and thus the prices of non-tradable goods and services such as wages. Such increased prices affect the prices of non-tradables, thereby leading to increased cost of production in the manufacturing sector.

In another respect, it has been observed that the abundance of natural resources has the tendency to result into rent-seeking and corruption. Countries with an abundance of natural resources usually experience massive rent-seeking as highly connected individuals use such connections to corner the resources of the country to enrich their self. The level of corruption in these countries is so high because rents from natural resources are hardly accounted for and they come without much labour on the part of those who manage them. Rents from resources tend to concentrate in the hands of the government in collaboration with a tiny number of businessmen, thus giving rise to high level of inequality and lower growth rate. As observed by Auty (2001), natural resource abundance could give rise to a false sense of security in the people and this manifest by delaying or out rightly abandoning vital reforms essential for the growth of the economy since the country can survive on export proceeds from natural resources alone. In developing countries of which the countries we sampled in our study belong, rent-seeking and corruption are common feature because huge multinational companies that usually control the extraction of these resources operate directly with the government that give them licenses to operate

Rent-seeking and corruption are rampant in most natural resource-rich countries because of poor institutions. In a bid to connect natural resources to economic growth, institutional theorists observe that weak and corrupt governments attract natural resource curse. Murshed (2004) argued that the pursuit of inappropriate policies can make a rich natural resource endowment to become a curse. The paper further noted that poor institutions are a prerequisite for inappropriate or bad policies, hence; to avoid the problem of a resource curse, good institutions are necessary. It is common in natural resource-rich countries to experience weak institutions and this accounts for the reasons why, despite the huge proceeds from these resources, these countries still struggle to develop. The growth part of a country has been identified to be dependent on institutional factors such as political, legal, economic and social. North (2005) is of the view that institutions can influence a country's economy positively and to corroborate this position, Rodrik (1999) and Pritchett (2000) noted how institutional quality provides for long-term economic growth of countries.

Of all the theoretical views in connection with the abundance of natural resources, the Dutch disease theory is very popular. The origin of the Dutch disease syndrome began with the experience of the Dutch around 1960s when she was awashed with huge revenue from the discovery of natural gas, but did not channel the proceeds properly to enhance her economy. During the 1970s, falling commodity prices adversely affected her revenue profile which later led to stagnation in her

economy. In a nutshell, the Dutch disease usually begins when a new resource which generates massive wealth is discovered. The huge revenue generated from this new resource leads to domestic currency appreciation in relation to the currency of the trading partner. With the huge proceeds also, resources are drawn away from some critical sectors but into the boom sector for the sake of export. As a result, earnings from the export of the resource unduly expand national income as a whole with a tendency to raise aggregate demand. With the non-tradable industries starved of resources, rising prices hit the domestic economy because the new source of wealth leads to increased demand and fall in the supply of non-tradable goods.

Empirical Literature and Contribution to Knowledge

The nexus between natural resources endowment and the performance of a country's economy has occupied the attention of some economists and policy makers over the years. Consequently, studies have been done at both country-specific and cross-country basis to investigate the impact of natural resources endowment on key economic variables, especially its influence on GDP.

On a country-specific basis, some studies have been conducted. For instance, in Mali, Alpha and Ding (2016) assessed the impact of natural resources endowment on economic growth over a period of 1990-2013. Under the framework of ECM, finding of the study showed that natural resources export impacts positively on growth. The paper however, finds that the interaction of natural resource export and corruption have negative impact on economic growth. For Nigeria, Amusa (2016) used ECM to investigate the link between natural resources endowment and economic growth. Finding shows that natural resources do not lead to sustained economic growth. Using an historical approach, Ali, *et. al.* (2017) contended that natural resources may not be regarded as a curse to a nation, but lack of functional institutions should be blamed. The paper noted that corruption and parochialism are among the major problems of resource-rich countries such as Nigeria. In another study for Nigeria, Fatai, *et. al*. (2017), using data spanning a period of 1970-2016, established the link between natural resources and economic growth. Finding shows no causality between natural resource abundance and economic growth in Nigeria.

In another study for Nigeria, Raggl (2017) found that sound institutional environment and low levels of corruption are growth-enhancing effects of natural resources. The paper observed that accumulations of human and physical capital as well as the quality of institutions and natural resource rents are important ingredients for a prosperous economic development in Nigeria. Ewubare and Kakain (2017**)** examined the impact of natural resource abundance on economic growth in Nigeria. By decomposing different sources of natural resources, findings show that while some types of natural resources impact positively to GDP, others impacted negatively to GDP. For Nigeria also, Ayobola, *et al*. (2018), using data over a period of 1981-2015 and under the framework of the ECM, showed that export diversification impacts positively on growth from the last two periods, but in the current period, it negatively effects growth. Kareem, *et al.* (2020) examined the impact of natural resources endowment, human capital development and economic growth in Nigeria using time series data from 1982 to 2016. The study found natural resources endowment and human capital development to significantly affect economic growth. In a study for Kuwait, Aljarallah and Angus (2020) used data over a period of 1984 to 2014 to show that resource rents increase per capita GDP only in the short-run; however, in the long run, resource rents reduces productivity, human capital, and institutional quality

For studies relating to cross-countries, Jalloh (2013) investigated the link between natural resources endowment and economic growth in West African countries. Under the framework of a dynamic panel estimation technique, finding indicates that natural resources endowment has very minimal

impact on economic growth, especially in resource-rich West African countries. By exploring the performance of the Extractive Industries Transparency Initiative (EITI) in resource-rich countries, Meaza (2014) finds that EITI falls short of increasing the economic growth of participating countries. The study also finds that transparency without other government reforms appears to be weak in promoting economic growth in resource-rich SSA countries**.** In another cross-country study involving nine African resource-rich countries, Ayadi (2017) applied the framework of the fixed effect model with cross section as well as time dummy variables to investigate the link between natural resources endowment and GDP. The paper did not establish a significant positive impact of resource extraction on economic growth.

To the best of our knowledge and from the previous literature reviewed in this paper, there is an absence of studies devoted to investigating the nexus between natural resources endowment and the performance of the manufacturing sector in sub-Saharan African natural resource-rich countries. This gap in knowledge was a major motivating factor for this study and we believe that our findings will broaden the horizon of knowledge in this area of study.

Analytical Framework

By borrowing a leaf from Aljarallah and Angus (2020), we applied the Cobb–Douglas production function as our framework of analysis. The Cobb–Douglas production function was used by two prominent scholars, Paul H. Douglas and C.W. Cobb to study the American manufacturing industry. In the function, output is modeled as a function of labour and capital inputs. A typical Cobb-Douglas production function can be expressed in equation 1 as follows:

$$Q_t = \mathrm{A}_t K_t^{\alpha} L_t^{\beta} \quad \text{.....(1)}$$

where

Q_t represents output at time t, K_t represents physical capital at time t, L_t represents human capital stock at time t, A_t represents efficiency level and α are β the output elasticity of capital and labour respectively. As the efficiency level (A_t) improves, the level of output gets higher and the Cobb-Douglas production function is assumed to exhibit a constant returns to scale. The expression for the output level can be derived by dividing equation 1 above by *L* on both sides:

$$\frac{Q_t}{L_t} = \mathrm{A}_t K_t^{\alpha} L_t^{\beta} \frac{1}{L_t} \quad \text{.....(2)}$$

By multiplying and dividing equation 2 by L_t^{β} and L_t^{α} respectively, the following expression in equation 3 below is obtained:

$$\frac{Q_t}{L_t} = \mathrm{A}\left(\frac{K_t^{\beta}}{L_t^{\beta}}\right) L_t^{\beta} \left(\frac{L_t^{\alpha}}{L_t^{\alpha}}\right) L_t^{\alpha} \frac{1}{L_t} \quad \text{.....(3)}$$

In equation 3, $\frac{Q_t}{L_t} = Q_t$, $\frac{K_t^{\beta}}{L_t^{\beta}} = K_t^{\beta}$, $\frac{L_t^{\alpha}}{L_t^{\alpha}} = 1$

Equation 3 becomes:

$$Q_t = AK_t^{\beta} L_t^{\beta} L_t^{\alpha} \frac{1}{L_t} \text{.....(4)}$$

By applying the concept of constant returns to scale in equation 4 above, that is, the assumption that $\beta + \alpha = 1$, the following expression in equation 5 below is obtained

$$Q_t = AK_1^{\beta} \text{.....(5)}$$

where

Q_t represent the output level and K_t represents capital stock which can be decomposed into physical capital and human capital stock.

After taking the natural logarithm of both sides of equation 5, the following expression in equation 6 below is obtained:

$$\ln(Q_t) = \ln(A) + \lambda \ln(K_t) \text{.....(6)}$$

3. Methodology

Given that the variables of interest exhibited a combination of I(0) and I(1) process, we resorted to a panel autoregressive distributed lag *(ARDL)* proposed by Pesaran et al. (1999). The benefit and the superiority of the panel *ARDL* model is that, unlike other conventional methods, it can be applied regardless of whether the selected variables in the model are purely I(0) or purely I(1) or a combination of I(0) and I(1). By modifying equation 6 above, the link between natural resources endowment and manufacturing sector performance can thus be simplified in equation 7 below as follows

$$MANVA_{ti} = f(NRR_{ti}, GFCF_{ti}, EMPIND_{it}, INFLR_{it}, RINTR_{it}, TOPEN_{it}) \text{.....(7)}$$

where

MANVA = Manufacturing valued added (a proxy for manufacturing sector's performance)
NRR = Natural resources rent (a proxy for natural resources endowment)
GFCF = Gross fixed capital formation (a proxy for physical stock of capital)
EMPIND = Employment in industry (a proxy for human capital devoted industry)
INFLR = Inflation in industry
RINTR = Real interest rate
TOPEN = trade openness

Equation 7 above indicates that the manufacturing value added *(MANVA)* is a function of natural resources rent *(NRR)* and other explanatory variables. We can therefore specify the relationship between the manufacturing value added and the natural resources rent in a panel *ARDL* form as follows**:**

$$\Delta MANVA_{it} = \alpha_0 + \lambda_1 MANVA_{it-1} + \lambda_2 NRR_{it-1} + \lambda_3 GFCF_{it-1} + \lambda_4 EMPIND_{it-1} + \lambda_5 INFLR_{it-1}$$

$$+ \lambda_6 RINTR_{it-1} + \lambda_7 TOPEN_{it-1} + \sum_{i=1}^{p} \phi_i \Delta MANVA_{it-1} + \sum_{i=1}^{p} \gamma_i \Delta NRR_{it-1} + \sum_{i=1}^{p} \psi_i \Delta GFCF_{it-1} +$$

$$\sum_{i=1}^{p} \pi_i EMPIND_{it-1} + \sum_{i=1}^{p} \zeta_i \Delta INFLR_{it-1} + \sum_{i=1}^{p} \vartheta_i \Delta RINTR_{it-1} + \sum_{i=1}^{p} \kappa_i \Delta TOPEN_{it-1} + \mu_{it} + \varepsilon_{it} \text{.....(8)}$$

where

i = 1, 2,…..stands for the country; t = 1, 2,…stands for the time period; while μ_{it} stands for country fixed effects and ε_{it} is the disturbance component. $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6 and \lambda_7$ are the long-run coefficients, while $\phi_i, \gamma_i, \psi_i, \pi_i, \varsigma_i, \vartheta_i and \kappa_i$ are the short-run coefficients. With the existence of a long-run relationship, equation 8 above can be transformed into a panel error correction model (PECM) as shown in equation 9 below:

$$\Delta MANVA_{it} = \alpha_0 + \sum_{i=1}^{p} \phi_i \Delta MANVA_{it-1} + \sum_{i=1}^{p} \gamma_i \Delta NRR_{it-1} + \sum_{i=1}^{p} \psi_i \Delta GFCF_{it-1} + \sum_{i=1}^{p} \pi_i EMPIND_{it-1} +$$

$$\sum_{i=1}^{p} \zeta_i \Delta INFLR_{it-1} + \sum_{i=1}^{p} \vartheta_i \Delta RINTR_{it-1} + \sum_{i=1}^{p} \kappa_i \Delta TOPEN_{it-1} + \phi ECM_{it-1} + \mu_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where ECM_{it-1} is the error correction part and ϕ is the coefficient of the error correction model which indicates the speed of adjustment from the short run dynamics to the long run equilibrium. The coefficient of the error correction model (ϕ) is expected to be negative and significant for long run equilibrium to exist between the manufacturing value added and the explanatory variables used in the model.

Variables used in the Study

Our interest in this paper is to investigate the link between natural resources endowment and the performance of the manufacturing sector in natural resource-rich sub-Saharan African countries. On the basis of this, we sourced annual data for 6 selected SSA countries from the World Bank's World Development Indicators (2020). The countries included in the study are Nigeria, South Africa, Botswana, Congo Democratic Republic, Sierra Leone and Mauritania. The grouping was done following a study by the Economic Commission for Africa (ECA, 2011) that grouped sub-Saharan African countries on the basis of resource-rich, resource-poor and landlocked countries. The rating was done on the basis that more (less) than 10% of the country's GDP comes from the primary commodity value added. Manufacturing value added as used in the study to proxy the performance of the manufacturing sector is defined by the United Nations Industrial Development Organization (UNIDO) as "the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate consumption". Of all the indicators of manufacturing sector performance in literature, we are motivated by this indicator because it has more bearing on natural resources since in calculating it, the depletion and degradation of natural resources are not allowed.

Total natural resource rent as a percentage of GDP is used to proxy natural resources endowment in the study following Ayadi (2017) and other studies. By definition, total natural resource rent comprises oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. Gross fixed capital formation as a percentage of GDP is used as indicator for physical capital stock. Gross fixed capital formation comprises expenditure on land improvements as well as spending on plant, equipment and machinery. We proxy human capital with employment in industry. This indicator is a departure from most studies that employed different proxies for labour force such as labour force participation rate, secondary school enrolment, etc. We opted for employment in

industry because as our interest is on the manufacturing sector, we believe that this indicator is closely linked to labour's contribution to the sector. Since interest rate is a cost of capital which is germane to the performance of the manufacturing sector, we used real interest rate in the study. Real interest rate is adopted instead of nominal interest rate because it is necessary to adjusted nominal interest rate for the impact of rising prices. Rising inflation is inimical to the manufacturing sector as it leads to increasing cost of inputs which makes the export of manufacture uncompetitive at the international market. Consequently, we included inflation in the study which we proxy by annual rate of inflation. To account for the impact of international trade on the manufacturing sector, we included trade openness in the study. This is calculated as the ratio of the sum of export and import to GDP.

4. Empirical Findings/Result

From table 1. below, it can be observed that the median and the mean variables are almost close, thus suggesting low variability and symmetry in the variables. We also found the mean values of the variables to be of good measures of central tendency owing to the fact that all of them lie midway between the maximum and minimum values. On the average, the value of *MANVA* is around 8.515300 per year, while the highest and lowest values are 10.72162 and 3.120240 respectively. For *NRR*, the average value obtained in the region is 11.38492, with the maximum and minimum values being 36.49801 and 0.657051 respectively. We are of the view that while the maximum value for *MANVA* is propelled mostly by the contribution of some industrialized countries within the SSA resource-rich countries such as Nigeria and South Africa, the maximum value for *NRR* is mostly contributed by oil-rich countries like Nigeria.

Table 1. Summary Statistics

	MANVA	NRR	EMPIND	GFCF	INFLR	RINTR	TOPEN
Mean	8.162662	11.38492	14.89112	22.60288	232.0537	6.406997	11.56942
Median	8.515300	9.448325	13.25500	21.02981	10.07764	5.942404	11.72876
Maximum	10.72162	36.49801	28.55000	93.54746	26765.86	32.76795	13.22011
Minimum	3.120240	0.657051	0.000000	0.000000	-7.091520	-31.69750	9.545307
Std. Dev.	2.401832	9.137259	7.503532	12.93866	2041.599	9.913296	1.024954
Skewness	-1.137246	0.750961	0.139377	0.960783	12.48549	-0.655505	-0.343680
Kurtosis	3.189356	2.595151	1.921542	6.693027	162.1775	5.677358	1.963745
Jarque-Bera	38.63467	17.94591	9.202416	128.5372	192544.4	65.91185	11.46832
Probability	0.000000	0.000127	0.010040	0.000000	0.000000	0.000000	0.003234
Sum	1452.954	2026.516	2650.620	4023.312	41305.55	1140.445	2059.356
Sum Sq. Dev	1021.077	14777.64	9965.629	29631.38	7.38E+08	17394.40	185.9438
Observations	178	178	178	178	178	178	178

Source: Authors' compilation

In order to investigate the order of integration of the series, we employed the Augmented Dickey-Fuller-Fisher (ADF-Fisher); Phillip Perron-Fsher (PP-Fisher), Levin, Lin and Chu (LLC) and Im, Peseran and Shin (IPS) unit root tests. We are guided by the decision rule that if the absolute p-value of the ADF-Fuller test, the PP-Fuller test, the LLC test and the IPS test is less than the 5 percent and 10 percent critical values, we conclude that the series are stationary or that there is no existence of unit roots. The reverse is the case if the absolute p-value is greater than the 5 percent or 10 percent critical values. In tables ii and iii below, the test for unit root is decomposed into two.

One part tested for the null hypothesis of the existence of unit root for the individual countries, while the other part tested for the existence of unit root for all the countries combined. In table ii below, it is evident that while majority of the series achieved stationary at level, ie are integrated of order one or I(0), results in table iii below indicate that at first difference, all the series achieved stationarity, ie, they become I(1).

Table 2. Panel Unit Root at Level

	Common Unit Root	**Individual Unit Root**		
	LLC	IPS	ADF-Fisher	PP-Fisher
MANVA	-1.60031(0.0548)**	0.31940(0.6253)	15.8996(0.1959)	9.86716(0.6276)
EMPIND	22.0266(1.0000)	1.10070(0.8645)	16.0678(0.1882)	176.720(0.0000)**
NRR	-1.73159(0.0417)**	-2.13907(0.0162)**	21.8413(0.0393)**	30.8753(0.0021)**
GFCF	-2.11267(0.0173)**	-2.20526(0.0137)`**	22.7924(0.0295)**	35.0049(0.0005)**
INFLR	-5.06676(0.0000)**	-4.96711(0.0000)**	47.8204(0.0000)**	56.9219(0.0000)**
RINTR	-3.55769(0.0002)**	-4.82372(0.0000)**	48.1155(0.0000)**	57.6225(0.0000)**
TOPEN	-1.94754(0.0257)**	1.22607(0.8899)	6.30656(0.8998)	18.8968(0.0910)***

Source: Authors' compilation Note: **, *** represent 5 and 10 percent level of significance respectively.

Table 3. Panel Unit Root at First Difference

	Common Unit Root	**Individual Unit Root**		
	LLC	IPS	ADF Fisher	PP-Fisher
ΔMANVA	-8.17593(0.0000)**	-7.64838(0.0000)**	76.0766(0.0000)**	102.532(0.0000)**
ΔEMPIND	117.546(1.0000)**	-3.01799(0.0013)**	30.5436(0.0023)**	110.524(0.0000)**
ΔNRR	-7.75567(0.0000)**	-9.06086(0.0000)**	91.398690.00000**	153.321(0.0000)**
ΔGFCF	-6.92952(0.0000)**	-7.65763(0.0000)**	76.5362(0.0000)**	104.383(0.0000)**
ΔINFLR	-5.71741(0.0000)**	-10.4125(0.0000)**	106.766(0.0000)**	152.398(0.0000)**
ΔRINTR	-7.23559(0.0000)**	-10.0658(0.0000)**	102.374(0.0000)**	157.382(0.0000)**
ΔTOPEN	-7.02833 (0.0000)**	-6.09969 (0.0000)**	59.0359 (0.0000)**	87.9075 (0.0000)**

Source: Authors' compilation Note: **, *** represent 5 and 10 percent level of significance respectively.

Pesaran *et al*. (2001) noted that in panel *ARDL* approach, the application of unit root test does not accommodate series that are integrated of order 2, ie I(2). Since our results do not exhibit this tendency, Panel *ARDL* appears to be more suitable technique for the estimation of both the long-run and the short-run relationships. However, before we proceeded to estimate the short and long-run impacts, we carried out a test of co-integration among the variables. The Kao residual co-integration test in table iv below guided us in this investigation. From the result, the coefficient of the lag of the residual is -0.219144 with a probability of 0.0003 which indicates the rejection of the null hypothesis of no co-integration at the 5 percent significant level. With this result, we conclude that a long-run relationship exists among the variables. The existence of a long-run relationship among the variables is further inferred by the negative and significant value of the coefficient of the error correction model (ECM). Since the coefficient of the ECM as shown in table iv below is -0.261305 which is significant at the 5% level, we conclude that a co-integration exists among the variables in our study. The result of the ECM implies that about 26% of errors generated in each period is automatically corrected by the system in the subsequent period.

Table 4. Kao Residual Co-integration Result

Kao Residual Co-integration Test
Series: MANVA NRR GFCF INFLR EMPIND RINTR TOPEN
Dependent Variable: D(RESID)
Sample (adjusted): 1992 2019
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.219144	0.059398	-3.689409	0.0003

Source: Authors' compilation

Having established the existence of a long-run relationship among the variables, we went ahead to estimate the results of both short and long-run impacts. From the results displayed in table v below, the short-run results indicate that natural resources endowment positively impacts on the performance of the manufacturing sector; however, the impact is not significant. By implication, even though natural resource endowments have a positive link with the manufacturing sector's performance in the selected natural resource-rich SSA countries, such impact cannot significantly improve the sector. We also find the gross fixed capital formation to contribute positively to the performance of the manufacturing sector in the short-run, while the contribution of labour force, even though it is positive; is not significant. In the short-run also, both inflation and real interest rate have a depressing influence on the manufacturing sector performance. Rising cost of production is a major factor that militates against the performance of manufacturing sector in any economy and for the natural resource-rich SSA countries that produce mainly light goods that have substitutes at the international market; this scenario can make the international price of their products to be uncompetitive.

Nigeria and Sierra Leone are the countries in the sampled natural resource-rich SSA countries that experience high level of inflation, therefore their combined high inflationary trend could account for much of the dampening impact of inflation on the manufacturing sector in the group. Since interest rate is part of production cost, rising interest rate in these countries also dampens the performance of the manufacturing sector. The negative impact of interest rate is mainly propelled by the interest rate situation in some sampled countries such as Mauritania and Congo Democratic Republic as interest rate in these countries is relatively high. Findings show that trade openness, even though has a positive link with the performance of the manufacturing sector, the impact is not significant. We contend that this is due to the fact that manufactured products in SSA countries are mostly products that have substitutes at the international market. Thus, their export price is fairly elastic and terms of trade in manufacture is usually not favourable.

Also, from the results in table v below, in the long-run natural resources endowment significantly and negatively impacts on the manufacturing sector performance. The implication of this result is that the presence of the abundance of natural resources in sub-Saharan African natural resource-rich countries displaces the manufacturing sector. This finding corroborates the theoretical view that the existence of abundance of natural resources has the tendency to crowd-out some real sectors of the economy. By receiving huge proceeds from natural resources, these countries fail to diversify their economies away from these traditional sources of income. As a further proof for the poor performance of the manufacturing sector, the long-run result of gross fixed capital formation shows that it negatively contributes to the manufacturing sector performance even though this contribution is not significant. We are of the view that the capacity utilization of these fixed inputs into manufacturing is low. While we find the result of employment in industry, trade openness and real interest rate to be in line with their apriori expectation, the result of inflation is conflicting. One

would have expected inflation to negatively affect the performance of the manufacturing sector; however the result indicates the opposite. One plausible reason that could account for this result is that manufacturing outfits in these economies take advantage of poor institutional controls to engage in profiteering during period of rising prices.

Dependent Variable: MANVA Selected Model: ARDL (2, 1, 1, 1, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob
Short-run Results				
ΔNRR	0.002347	0.003630	0.646599	0.5191
ΔGFCF	0.002023	0.001087	1.860814	0.0653
ΔEMPIND	0.045825	0.041963	1.092041	0.2770
ΔINFLR	-0.007218	0.003513	-2.054353	0.0422
ΔRINTR	-0.005497	0.003199	-1.718525	0.0883
ΔTOPEN	0.046389	0.068330	0.678904	0.4985
ECM(-1)	-0.261305	0.137262	-1.903696	0.0594
Long-run Results				
NRR	-0.002667	0.001084	-2.460859	0.0153
GFCF	-0.001081	0.000863	-1.252961	0.2127
EMPIND	0.029107	0.016497	1.764344	0.0803
INFLR	0.003033	0.001751	1.731533	0.0860
RINTR	-0.000876	0.001410	-0.621302	0.5356
TOPEN	0.424305	0.029732	14.27093	0.0000
C	0.961483	0.491015	1.958155	0.0526

Table 5. ARDL Results
Source: Authors' compilation

5. Discussion

Our aim in this study is to investigate the link between natural resources endowment and the performance of the manufacturing sector in natural resource-rich sub-Saharan African countries. Applying different panel unit root tests, we found that the series exhibited an admixture of I(0) and I(1) and that informs the choice of a panel *ARDL*. Using time series dataset over a period of 1990-2019, our findings showed that in the short-run natural resources has a positive link with the manufacturing sector performance even though this is not significant. In the long-run however, the contribution of natural resources to the performance of the manufacturing sector becomes negative. On the basis of this, we contend that the presence of natural resources in SSA natural resource-rich countries can act as disincentive to the manufacturing sector. The negative impact of natural resource endowments on the manufacturing sector performance in the SSA natural resource-rich countries amplifies the resource curse hypothesis and this has implications for policy making.

Based on the foregoing, we suggest that SSA natural resource-rich countries should diversify their economies away from the traditional natural resource base by developing their manufacturing sector. They should borrow a leaf from some natural resource-rich countries like the oil-rich Norway that uses the proceeds from her oil export to develop critical infrastructure needed to propel the manufacturing sector. Gylfason (2011) observed that resource-rich countries urgently require diversification because the concentration of natural resource wealth is in the hands of a tiny group who strives to resist attempts at reforms. Accordingly, this group always stands in the way of any form of economic and political diversification that tend to channel the resource rents to their rightful

owners. A major key to achieving diversification is development of sound human resources that can drive the growth process. Thus, investment in human capital is very paramount. There is also need for institutional reforms in order to remove all structural rigidities that hamper the development of the manufacturing sector. Inflation should be tackled so as to make export of manufacture to be competitive at the international market and with falling inflation, interest rate will be reduced. Finally, as a way to enhance the prospect of export of manufacture, we advise that SSA natural resource-rich countries should diversify their productive base by delving into the manufacture of capital goods that have less substitutes at the international market.

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