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HARNESSING RESOURCE RENTS FOR DEBT REDUCTION: A STUDY OF OIL-RICH SUB-SAHARAN AFRICAN COUNTRIES

ABSTRACT: *This paper examines the effect of oil resource rents and economic complexity on the debt burden of five oil-rich Sub-Saharan African countries between 1995 and 2019. A panel autoregressive distributed lag estimation technique was used to estimate the models; the results reveal a negative and significant impact of economic complexity and natural resources rents on debt services of the selected oil-rich African countries. The paper also shows that using natural resources rents to enhance the complexity of the economy reduces public debt burdens. The implication is that greater economic complexity and natural resources rents may reduce the tendency of oil-rich countries to experience debt crises in the long run. The paper recommends that a greater deployment of natural resources rents for productive purposes may create a conducive investment climate, reducing the incidence of debt. Finally, policy makers in these economies should take advantage of natural resources rents to diversify their economies in order to deepen economic complexity and reduce the burden of public debt.*

KEY WORDS: *Oil resource rent, economic complexity, public debt burden*

JEL CLASSIFICATION: O13, F34, Q43, Q55

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1. INTRODUCTION

The assertion that a nation's resource endowment is both a curse and a blessing remain inconclusive. Some countries have improved their citizens' welfare by making the most of their natural resources. The availability of natural resources has been identified as a pre-condition for take off in Rostow's theory of stages of economic development (Arora, 2022; Muda et al., 2020; Rostow, 1959). While this affirms the case for resource endowment-led growth, there is an abundance of literature to the contrary that refutes it, as many resource-rich economies are ensnared in a cycle of poverty characterised by high capital flights and low living standards (Badeeb et al., 2017; Ndikumana & Sarr, 2019; Tabash et al., 2022). According to the literature, resource-rich countries are more likely to use their natural resources as collateral for debt in international markets, which can lead to debt crises and economic volatility (Frynas & Buur, 2020; Melina et al., 2016; Sarr et al., 2011).

Moreover, there have been concerns about the possibility of a new sovereign debt crises in sub-Saharan African (SSA) countries (Odior & Iwegbu, 2021). The effects of the 1990s' debt crises are still evident in most countries in SSA. The Multilateral Debt Relief Initiative (MDRI) for the complete forgiveness of debts owed by a group of 36 low-income poor countries was adopted by representatives from major creditor countries (a group known as the Paris Club) and multilateral organisations. The majority of these countries (precisely, 29 countries) were in Africa. Large-scale debt relief was contingent on prudent economic management and anti-poverty initiatives. Resource-intensive nations continue to experience deficits, and their economies were accompanied by debt rising more rapidly. The International Monetary Fund (IMF) in its Regional Economic Outlook for SSA classified eight countries in the region as oil exporters (IMF, 2022).

Through the Economic Complexity Index (ECI), the Growth Lab at Harvard University (2019) evaluate the current level of a nation's productive knowledge. It measures the variety and complexity of the goods countries successfully export. The ECI is determined by the level of knowledge as shown by the products a country produces. The variety of exports a nation produces and their pervasiveness, or the number of nations able to produce them (and the complexity of those nations), are used to determine a nation's economic complexity. A more diversified economy with complex exports implies a higher

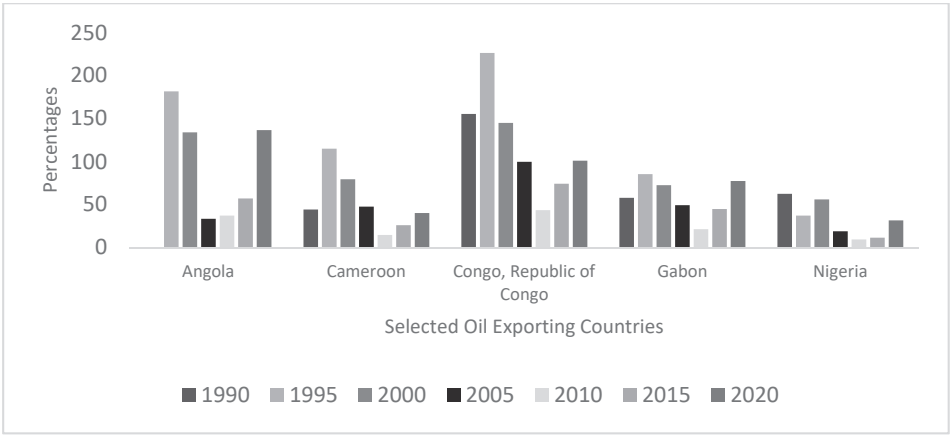
ECI and economic development. Three Asian countries (Japan, South Korea and Singapore) are ranked among the five countries with the highest ECI. These countries are, however, not endowed with natural resources. The ECI of African countries are particularly low with South Africa (60th position) as the most complex country in Africa. Oil-exporting countries in SSA are ranked between the 125th and 133rd positions, where Nigeria is ranked as the lowest ECI country.

The high ECI for Asian countries therefore demonstrates the complexity of exports in these countries in contrast to the dependence on primary exports in SSA countries. The linkage between oil rents, debt crises and economic complexity has not been exhaustively explored in the literature. This present study attempts to examine whether oil resources and economic complexity have a significant effect on debt in SSA. The study also explores the impact of economic complexity on debt crises and the effect of oil resources on debt crises in SSA. We employ five countries (Angola, Republic of Congo, Gabon, Nigeria and Cameroon) from the IMF's classification of eight oil-exporting countries; South Sudan, Equatorial Guinea and Chad were omitted due to lack of data on the ECI (IMF, 2022). The data span from 1995 to 2019 to measure the effect of economic complexity. The remainder of the paper is organised as follows: Section 2 describes stylised facts while Section 3 provides the literature review. Section 4 presents the methodology and dataset and Section 5 the empirical results. Lastly, Section 6 concludes and offers policy recommendations.

2. STYLISED FACTS

The Heavily Indebted Poor Countries (HIPC) and MDRI debt reduction programmes helped SSA countries in the late 1990s. As a result, the average level of government debt as a percentage of GDP dropped significantly for all these countries, as seen in Figure 1. Debt as a percentage of gross domestic product peaked in 1995 at 226.3% for Republic of Congo and has since dropped to 145% in 2000 and 101% in 2020. There is clear evidence of the link between the resource boom and indebtedness in the selected countries. The country's external debt stocks have increased very sharply since the large gas discovery in 2010 (Fig. 1) when it became known that the massive quantities of natural gas could serve as collateral for further contraction of loans overseas.

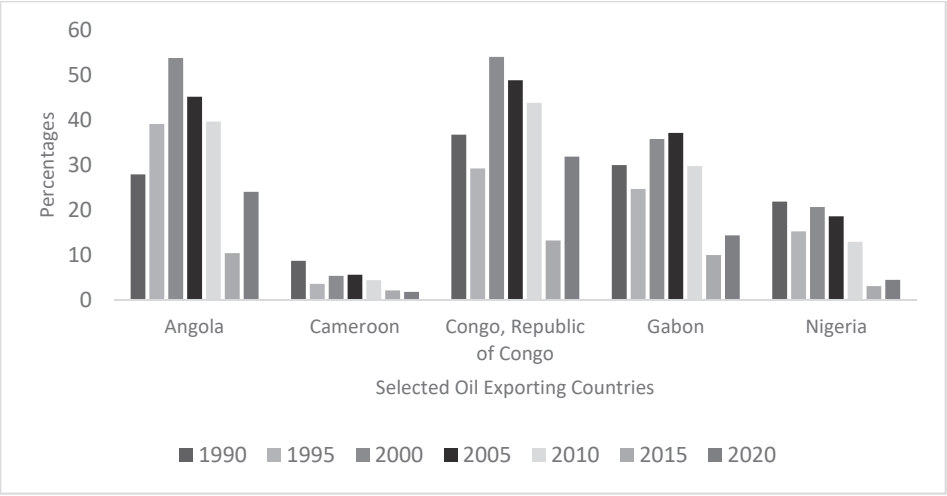
Figure 1: Government debt for the selected oil-exporting countries (% of GDP)



Source: World Bank – World Development Indicators online database

Figure 2 presents oil rents for the selected countries from 1990 to 2020. Oil rents gradually increased between 1990 and 2010 but declined sharply in 2015 and then mostly increased significantly in 2020. Comparing Figures 1 and 2, we can infer that there is an inverse pattern between both. As oil rents increase, public debt decreases, while when oil rents start declining, public debt begins to rise. This relationship demonstrates how increased natural resource revenues may initially support debt reduction by providing surplus funds that reduce reliance on borrowing. However, as oil rents decrease, the governments turn to debt financing to offset the revenue shortfalls, leading to an upward trend in public debt. This cyclical pattern underscores the fiscal challenges of managing public debt in natural resource-dependent economies, where fluctuations in natural resources rents directly impact debt sustainability and the need for strategic financial planning during revenue downturns.

Figure 2: Oil Rents for the selected oil-exporting countries (% of GDP)



Source: World Bank – World Development Indicators online database

3. LITERATURE REVIEW

Theoretically, the existing literature provides a relationship between natural resource ownership and growth of the economy, with a strand explaining why certain oil-rich countries enjoy sustainable economic growth, while others that are developing experience stunted growth. The theories explain the transmission mechanism through which these economies experience such growth (Brunnschweiler & Bulte, 2008). The resource curse hypothesis validates the proposition that resource-rich countries experience slower economic growth, poor governance and increased public debt compared to resource-poor countries and this causes volatility in foreign exchange earnings because of the volatility in prices of natural resources. During the period of high prices of natural resources with consequential currency appreciation, the government of such an economy borrows more in the belief that the increase in prices will be sufficient to offset the borrowings. However, debt unsustainability sets in when the prices fall and this results in fiscal crises (Poelhekke, 2009; Sachs & Warner, 1995; van der Ploeg, 2011). Challenges in the governance structure of the economies also contribute to debt crises and too much accumulation of debt. Most of the governments of oil-rich economies encourage corruption and wastage of resources through their rent-seeking behaviour because the institutional framework that would normally

provide checks and balances on their actions is weak (Mehlum et al., 2006). These governance issues limit a country's ability to generate long-term economic growth from resource wealth and increase its dependence on external debt. Empirical studies show that resource-rich countries with poor institutional quality are more likely to experience debt distress due to poor policy choices and a lack of accountability in fiscal management (Collier & Hoeffler, 2009).

Furthermore, the resource curse hypothesis suggests that resource booms reduce competitiveness in other sectors, particularly manufacturing, which limits economic diversification, and this exposes them more to economic shocks, making them significantly rely on debt as a financial buffer against revenue volatility (Auty & Kiiski, 2001; van der Ploeg, 2011). The neglect of these other critical sectors leads to abandonment and lean sources of revenue to achieve sustainable economic growth and development (Corden & Neary, 1982). During natural resource booms, there is a huge neglect of human capital development, which is necessary for sustainable growth, as suggested by endogenous growth theory. This leaves these economies vulnerable when resource revenues decline (Romer, 1986).

In other related literature, international trade theory suggests that natural resource dependent countries concentrate on exporting their natural resources, resulting in reduced export diversification, fiscal unpredictability and an increased likelihood of borrowing to stabilise public finances during downturns (Ricardo, 1817; Deaton, 1999). However, Arezki et al. (2017) posited that effective management of the natural resources can help these rich natural resource countries to enjoy fiscal stability, thereby avoiding debt overhang. Some of the countries that have adopted these strategies include Norway, who implemented sovereign wealth funds and prudent fiscal policies to save surplus resource revenues, allowing for economic stability and debt management during market downturns. In essence, the relationship between natural resources and public debt is significantly influenced by governance quality, fiscal policies and economic diversification efforts (Arezki et al., 2017; van der Ploeg, 2011).

Due to the varied empirical data, the relationship between oil resources and public debt has occupied much of the literature. However, this study departs from previous research by incorporating economic complexity into the debate on oil

resources and public debt. Consequently, the study examines the relevant literature in two distinct ways. First, the literature demonstrates that oil resource endowment is a source of revenue that might lower public debt stock, and second, evidence demonstrates that oil resource endowment is a curse that leads to larger debt stock and economic complexity as a link.

Table 1a: Summary of empirical literature

S/N	Author	Year covered	Country	Methods	Findings
1	Sadik-Zada and Gatto (2019)	2013	184 countries	Cross-country linear regression	The share of oil rents, share of mineral rents, and economic growth all have a negative impact on public debt growth, whereas interest rate payments have a positive impact on public debt.
2	Ghecham (2020)	1996–2018	6 OPEC oil-exporting countries	Stochastic frontier analysis (SFA)	The improper distribution of oil resources has a negative effect on public debt.
3	Chuku et al. (2021)	2000–2017	18 African economies	endogenous Binary-treatment regression models	Chinese loans have a positive impact on physical and economic oil abundance. However, a negative effect of public debt sustainability is found.
4	Ampofo et al. (2021)	1991–2017	17 mineral-rich countries	Pooled mean group-ARDL and VECM	In the long run, resource rent has a positive impact on public debt. Therefore, overdependence on natural resource rents affects public debt sustainability. Resource rents and public debt have an established bidirectional causal link.
5	Melina, Yang & Zanna (2016)		Developing countries	DSGE model called debt, investment, growth, and natural resou rces (DIGNAR)	Resource funds combined with acyclical government spending can reduce macroeconomic instability. However, high debt level and ambitious public investment may lead to debt sustainability risks especially when resource funds are lower than expected.

6	Canh et al. (2020)	2002–2017	90 countries divided into low and lower-middle income (LMEs), upper-middle income (UMEs) and high income economies (HIEs)	Generalised method of moments (GMM) model and sequential (two-stage) estimation of linear panel-data models (SELPDM)	In LMEs and HIEs, economic complexity has a minimal effect on total natural rents, whereas in UMEs it has no effect. Complexity has a diminished effect on mineral and natural gas rents, but is likely to boost coal rents.
7	Tabash et al. (2022)	1995–2017	24 African economies	GMM model	Natural resources rents have a negative impact on economic growth while economic complexity has a positive impact on economic growth. When economic complexity interacts with natural resources, however, the effect on economic growth is favourable.

Source: Authors' compilation from desk review

Table 1b: Continuation of summary of empirical literature

S/N	Author	Year covered	Country	Methods	Findings
8	Abdulahi et al. (2019)	1998–2016	14 resource-rich countries of SSA	OLS standard error and White-correlated standard error models and system (GMM)	Resource rent has a positive impact on economic growth when a country's institutional quality is above the threshold level
9	Dong et al. (2019)	2014–2015	China	Probit model regression	Coal output has a positive impact on corruption. Coal mining encourages graft at all levels of government in affected areas.
10	Ajide (2022)	1995–2018	32 African economies	pooled OLS, fixed effects, random effects and generalised method of moments (GMM)	The theory of the resource curse is supported by economic complexity.

11	Khan et al. (2020)	1985–2017	China	ARDL & VECM	In the long run, there is a bidirectional causal relationship between FDI and economic complexity. The rapid economic emergence of China is credited to its products and economic complexity.
12	Frynas & Buur (2020)	1995–2015	3 African countries (Sao Tome and Principe, Madagascar and Mozambique)	Exploratory	All the three countries experienced the negative effects of anticipation of future extractive revenues including low economic growth, high debt levels, and eroded governance and social conflicts.
13	Ndikumana and Sarr (2019)	1970–2015	30 African countries	Fixed-effects	Natural resources rents are associated with high capital flight and the quality of institution does not mitigate this link.
14	Adams et al. (2019)		Ghana	Stratified simple random sampling, descriptive and regression analyses	In order to avoid the resource curse, a government needs more than only Extractive Industries Transparency Initiative (EITI) participation and petroleum revenue management regulations.

Source: Authors' compilation from desk review

4. RESEARCH METHODOLOGY

To achieve the research objective, we adapt the model specified by Sadik-Zada and Gatto (2019) only to the extent that we introduce the economic complexity index into the model and vary other explanatory variables employed in the model. Thus, the implicit function of our model is specified as:

$$GDEBT = f\left(GDPC, OILR, ECI, LF, INV, TOP, CC, OILR * ECI\right). \quad (1)$$

Equation (1) suggests that debt service is a function of gross domestic product per capita, oil rent, the economic complexity index, the labour force, investment, trade openness and interactive variables between oil resource rent and the economic complexity index. Theoretically, economic complexity enables countries to reduce dependency on volatile resource rents by promoting diversified industries that can sustain revenue generation (Hidalgo & Hausmann,

2009). Countries with higher economic complexity tend to be more resilient to resource price fluctuations, as they can offset downturns in resource revenues with income from other sectors, mitigating the adverse effects on debt service (Hartmann et al., 2017). Furthermore, resource rents in complex economies are more likely to be allocated to infrastructure and institutional investments that support economic stability and debt sustainability (Mazzucato, 2013). This theory aligns with the resource curse literature, which argues that resource-rich countries with less economic diversification often experience weaker fiscal outcomes and higher debt burdens (Sachs & Warner, 1995).

Equation (1) can be further expanded explicitly in econometric form as an autoregressive distributed lagged model and is thus specified as:

$$\begin{aligned} GDEBT_{m,t} = {} & \varphi_0 + \varphi_1 GDPC_{m,t} + \varphi_2 OILR_{m,t} + \varphi_3 ECI_{m,t} + \varphi_4 LF_{m,t} + \varphi_5 INV_{m,t} + \varphi_6 TOP_{m,t} \\ & + \varphi_7 CC_{m,t} + \varphi_8 (OILR * ECI)_{m,t} + \lambda_1 \sum_{i=1}^{\rho} \Delta GDPC_{m,t-\rho} + \lambda_2 \sum_{i=1}^{\rho} \Delta OILR_{m,t-\rho} \\ & + \lambda_3 \sum_{i=1}^{\rho} \Delta ECI_{m,t-\rho} + \lambda_4 \sum_{i=1}^{\rho} \Delta LF_{m,t-\rho} + \lambda_5 \sum_{i=1}^{\rho} \Delta INV_{m,t-\rho} + \lambda_6 \sum_{i=1}^{\rho} \Delta TOP_{m,t-\rho} \\ & + \lambda_7 \sum_{i=1}^{\rho} \Delta CC_{m,t-\rho} + \lambda_8 \sum_{i=1}^{\rho} \Delta (OILR * ECI)_{m,t-\rho} + \mu_{it} \end{aligned} \tag{2}$$

Equation (2) shows that the long run coefficients are $\varphi_0 \longrightarrow \varphi_8$ while the short run coefficients are $\lambda_0 \longrightarrow \lambda_8$. The choice of the lags ρ for each variable in the short run is determined using the least Akaike Information Criterion (AIC), while each of the variables is for the respective oil-rich country *m* at time *t*. The definition, measurement and source of the variables employed are presented in Table 2. Three models are estimated: the first model is estimated without considering the economic complexity index (ECI) and the interaction between economic complexity and oil resource rent (OILR*ECI), while the second model includes the economic complexity index (ECI) amongst other variables specified in equation (2) but without the interaction term. The third model estimates the entire model while considering the interaction term. The separation of the model is to establish the effect of economic complexity and understand how its interaction with the oil resource affects the public debt of these selected oil-rich

nations. In order to estimate equation (2), the panel autoregressive distributed lag (PARDL) model is employed. The PARDL model is appropriate in estimating panel models that have mixed order of stationarity at level and at first difference. It is also appropriate in capturing the long-run model and the short-run model in a regression model. Prior to the estimation of the PARDL model, preliminary correlation analysis and unit root testing using the Levin et al. (2002) and Breitung (2001) statistics and panel cointegration test will be carried out.

Table 2: Data description and source

Variable	Identification	Definition	Source
GDEBT	Debt Service	Debt service on external debt	WDI 2021
GDPC	Gross Domestic Product	GDP per capita (constant 2015 US$)	WDI 2021
OILR	Oil rent	Oil rents (% of GDP)	WDI 2021
LF	Labour force, total	Total labour force	WDI 2021
ECI	Economic complexity index	The economic complexity index is a ranking of countries based on the diversity and complexity of their export basket	Harvard Growth Lab, 2021
INV	Investment	Gross fixed capital formation as a % of GDP	WDI 2021
TOP	Trade Openness	This is captured with trade as a % of GDP	WDI 2021
OILR*ECI	Interactive Variable	Oil rent is interacted with the economic complexity index	Derived
CC	Corruption perception index	This scores countries on the perceived levels of government corruption by country.	WDI 2021

Source: Researcher's compilation and WDI = World Development Indicator

5. PRESENTATION AND ANALYSIS OF RESULTS

This section presents some descriptive statistics on the variables employed and other pre-estimation tests that are necessary in order to ensure that we do not estimate a spurious regression.

Table 3: Summary statistics of panel variables employed

	GDEBT	GDPC	OILR	ECI	LF	INV	CC
Mean	3.754	7.854	2.693	-1.500	15.360	3.207	-1.186
Median	3.759	7.731	2.939	-1.538	15.857	3.178	-1.186
Maximum	5.439	9.134	4.016	-0.511	17.947	4.395	-0.520
Minimum	1.985	6.927	0.419	-2.506	12.661	2.651	-1.648
Std. Dev.	0.821	0.638	0.976	0.376	1.689	0.337	0.245
Skewness	-0.110	0.675	-0.645	0.138	-0.035	1.003	0.613
Kurtosis	2.385	2.317	2.291	2.962	1.743	4.456	3.056
Jarque-Bera	2.130	11.446	10.826	0.390	7.930	30.734	7.537
Probability	0.345	0.003	0.004	0.823	0.019	0.000	0.023
Sum	450.537	942.431	323.178	-179.962	1843.143	384.805	-142.370
Observations	120	120	120	120	120	120	120

Source: Authors' computation using data from world development indicators

From Table 3, the average rate of change in debt service was 3.8 while its maximum value was 5.4. However, the rate of change in debt service for a particular country was as low as 1.99. Converting the value of debt service to rates of change reduced the extent of variation associated with the trend of the variable. Also, the rate of change in per capita GDP stood at an average of 7.9 over the period in consideration while it ranged between a minimum value of 6.9 and a maximum value of 9.1. The rate of change in oil revenue was minimal at an average of 2.7 but had a maximum rate of change of 4.02. The countries under consideration had an average negative ranking of their complexity and the range of the complexity was never favourable as a positive maximum value was not achieved. The rate of change in labour force was high with an average value of 15.36 and fluctuated between 12.66 and 17.95. Gross fixed capital formation, a measure of investment, experienced a low rate of change as an average value of 3.21 was recorded with a peak value of 4.4 and a minimum value of 2.65. The measure of institution and control of corruption never recorded a favourable rating. The perception index with respect to the control of corruption remained in the negative range between -1.65 and -0.520 on a ranking that spans between -2.5 and +2.5.

The skewness and kurtosis help us to understand the pattern of distribution of the series. Alternatively, using the Jarque–Bera probability value, it can be determined that the rate of change in debt service and the economic complexity

index is normally distributed as the probability values are greater than 0.05 and therefore the null hypothesis of normal distribution cannot be rejected. However, the rate of change in per capita GDP, oil revenue, labour force, investment and control of corruption index are not normally distributed as the probability values are less than 0.05, which therefore rejects the null hypothesis of normal distribution and accepts the alternative that the variables are not normally distributed.

Table 4: Panel correlation analysis

	GDEBT	GDPC	OILR	ECI	LF	INV	CC	TOP
GDEBT	1.000							
GDPC	0.091	1.000						
OILR	0.297	0.499	1.000					
ECI	0.079	0.026	-0.149	1.000				
LF	-0.550	-0.650	-0.469	-0.390	1.000			
INV	0.265	0.145	0.450	0.070	-0.281	1.000		
CC	-0.241	0.299	-0.015	-0.117	0.009	0.066	1.000	
TOP	0.582	0.378	0.787	0.225	-0.738	0.534	-0.202	1.000

Source: Authors' computation using data from world development indicators

Furthermore, we conducted a correlation analysis to understand the degree of relationship that exists between our variables of interest. Table 4 presents the results of the correlation analysis. Firstly, we observe that the highest degree of relationship is between labour force and trade openness at -0.7. Although this is very high, it does not suggest the possibility of perfect multicollinearity associated with the regression result. A close examination of our variables of interest shows that there is a weak positive relationship between the extent of economic complexity and debt service, while there is a weak negative correlation between economic complexity index and oil rent. There is also a weak positive correlation between oil rent and debt service for the group of economies examined.

Table 5: Panel unit root result

	Level		First difference	
Variables	**LLC**	**Breit**	**LLC**	**Breit**
GDEBT	1.856	1.177	-5.667***	-4.028***
GDPC	2.632	1.825	-1.261*	-2.952***
OILR	-4.269***	-5.375***	–	–
LF	-1.672**	4.339	–	-1.448*
ECI	-2.915***	-2.127**	–	–
INV	1.059	1.421	-4.929***	-3.456***
TOP	-1.587*	-2.985***	–	–
CC	-0.070	-0.479	-2.898***	-3.888***

Note: LLC represents Levin et al. (2002), Breit represents Breitung (2001) statistics; * means 10%, ** means 5%; *** means 1% significance levels

Source: Authors' computation using data from world development indicators

Table 5 shows the results of the panel unit root test, which indicate that debt service, gross domestic product per capita, investment and control of corruption are not stationary at levels as their LLC and Breitung statistics are not significant at the 10% level. Hence, the null hypothesis cannot be rejected, leading to the conclusion that these variables have unit root at level and are therefore not stationary. We then further examined these variables at first difference and the result shows that they are stationary at first difference as the LLC and Breitung statistics are at least significant at the 10% level, leading to the conclusion that these variables are stationary at first difference. The results show that oil resource rent, labour force, the economic complexity index and trade openness are stationary at levels as the LLC and Breitung statistics are significant at least the 10% level and we then reject the null hypothesis and conclude that oil resource rent, labour force, economic complexity index and trade openness are stationary at levels.

Table 6: Cointegration result

Method	**Statistic**	**Prob.**	**Weighted statistic**	**Prob.**
Alternative hypothesis: individual AR coefs. (within-dimension)				
Panel v-statistic	-0.304	0.620	-1.534	0.938
Panel rho-statistic	0.782	0.783	1.067	0.857
Panel PP-statistic	-3.702	0.000	-5.552	0.000
Panel ADF-statistic	-1.541	0.062	-4.873	0.000
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-statistic	1.726	0.958		
Group PP-statistic	-7.513	0.000		
Group ADF-statistic	-4.006	0.000		

Source: Authors' computation using data from world development indicators

We also investigated the cointegration of the variables using the panel v, rho, Phillips–Perron and augmented Dickey Fuller statistics and the results in Table 6 show that there is a long-run relationship associated with the regression results using the Phillips–Perron and augmented Dickey Fuller statistics. This becomes evident given that the Phillips–Perron and augmented Dickey Fuller statistics are statistically significant at the 1% level, leading to rejection of the null hypothesis of no cointegration in the within- and between-dimensions associated with the regression result.

Table 7: Empirical result using panel autoregressive distributed lag model (PARDL)

Regressors	Dependent variable LOG(GDEBT)		
	I	II	III
Selected model	PARDL(1,1,1,1,1,1,1)	PARDL(1,1,1,1,1,1,1,1)	PARDL(1,1,1,1,1,1,1,1,1)
	A. Long-run estimates		
LOG(GDPC)	0.497 (0.497)	0.535 (2.480)	10.570 (3.470)***
OILR	0.001 (0.010)	-0.080 (0.018)***	-0.022 (0.006)***
LOG(LF)	1.659 (0.561)***	-1.737 (0.548)**	-1.714 (0.469)***
INV	-0.023 (0.014)*	-0.021 (0.017)	-0.088 (0.015)***
TOP	-0.013 (0.006)**	-0.004 (0.017)	-0.055 (0.014)***
CC	-0.861 (0.495)*	-6.912 (1.224)***	-8.833 (0.648)***
ECI	–	-7.418 (1.159)***	-10.845 (0.771)***
OILR*ECI	–	–	-0.089 (0.041)**
	B. Short-run estimates		
COINTEQ01	-0.725 (0.206)***	-0.334 (0.166)**	-0.268 (0.163)*
Δ	-2.585 (1.850)		
LOG(GDPC)		-1.986 (1.698)	-1.601 (0.068)***
Δ (OILR)	0.018 (0.009)**	0.022 (0.008)**	-0.127 (0.050)**
Δ LOG(LF)	8.494 (6.853)	0.462 (28.686)	38.784 (34.788)
Δ (INV)	0.083 (0.005)***	0.080 (0.014)***	0.090 (0.014)***
Δ (TOP)	-0.011 (0.011)	-0.016 (0.012)	0.001 (0.017)
Δ (CC)	1.690 (0.458)***	1.421 (0.788)*	2.374 (1.328)*
Δ (ECI)	–	1.275 (0.603)**	-1.939 (0.970)**
Δ (ECI*OILR)	–	–	-0.086 (0.009)***
Constant	-5.786 (1.452)***	8.725 (3.855)**	-17.149 (6.507)**

Note: *** specifies 1% level of significance, ** specifies 5% level of significance, * specifies 10% level of significance, ( ) specifies standard error.

Table 7 presents the results of the regression where debt is the dependent variable while there are other explanatory variables. To reduce the skewness of variables and make them normally distributed so as to have a better fit of the regression line, and also reduce scale differences with others, gross domestic product (GDPC), debt service (DEBT) and labour force (LF) were logged to base 10 and thus renamed as LOG(GDPC), LOG(DEBT) and LOG(LF), respectively. The coefficients of LOG(GDPC) and LOG(LF) are interpreted as growth rates. Recall that our objective is to understand the effect of economic complexity and natural resources on debt in five selected oil-exporting countries in SSA (Angola, Republic of Congo, Gabon, Nigeria and Cameroon). The results of the last two

models show that, in the long run, there is a negative and significant impact of oil resource rent on debt among the oil-rich countries, signifying the effect of economic complexity. The implication of this finding is that oil resource rent leads to a reduction in debt burden for these countries. In the second and third models, the results show that there is a negative and significant impact of the economic complexity index on the debt burden of these countries in the long run. The implication of this finding is that increases in the complexity of the economy result in lower debt burden in the form of debt services for these countries. This finding confirms the findings of Sadik-Zada and Gatto (2019), whose study found that the share of oil rents, share of mineral rents and economic growth all have a negative impact on public debt growth.

Furthermore, we examined the effect of utilising the natural resources rent to deepen the export capacity of these oil countries on debt burden for these countries. This is achieved by considering the interactive effect of economic complexity and natural resources rent on the debt burden of the oil-rich countries. The result of the estimation reveals that greater utilisation of the natural resources rent towards enhancing the complexity of the economy reduces the public debt burden associated with these economies; this is as revealed in the third model result.

The results confirm the apriori expectation in the long run. It is, however, slightly different in the short run. In the short run, the results reveal that there is a positive impact of the natural economic complexity index on debt burden of the oil-rich economies without the interaction. The implication of this is that deepening the complexity of the oil-rich economies' export trade cannot reduce the debt burden of these countries in the short term (expect with the inclusion of interaction), but this will have significant effect in the long term. The introduction of the interaction term reveals that economic complexity and natural resource rents reduce the public debt burden of the selected oil-rich countries both in the short run and in the long run. Thus, countries with higher economic complexity are better positioned to manage debt service obligations when they have resource revenues. This implies that as countries with diversified and complex economies receive income from natural resources, they may use these funds more effectively, potentially reducing debt burdens by fostering more sustainable and productive investments. The interaction indicates that complex economies are more capable

of channelling resource rents toward long-term growth trajectory and debt reduction, instead of falling into the resource dependency trap that can exacerbate debt levels.

An examination of other factors that affect debt burden of the oil-rich economies reveals that deepening the investment profile of these countries reduces the debt burden associated with these economies in the long run, while controlling corruption in the long term also reduces the debt burden of the oil-rich economies. In the short run, greater deployment of the countries' labour force does not result in a reduction in the debt burden of the economies and this is also the same for trade openness in the third model.

6. CONCLUSION AND RECOMMENDATION

This study examines the impact of economic complexity on debt crises and the effect of oil resources on debt crises in SSA. The study has also examined the effect of deploying natural resources rents in deepening the complexity of these African countries' debt crises in SSA. In order to achieve these objectives, five oil-rich countries are selected from the IMF's classification of eight oil-exporting countries, while the data covered the period between 1995 and 2019 to measure the effect of economic complexity and natural resources on debt crises. The results the study show that economic complexity reduces the tendencies of these oil-rich countries to experience debt crises in the long term. Thus, the study concludes that there is a negative and significant impact of economic complexity on debt crises in these African countries. The study further examined how natural resources rent affects the debt burden of these countries and the results also show that the natural resources rent helps in ameliorating the debt burden experienced by these SSA countries due to the contraction of debt. More interestingly, the findings of the study indicate that greater utilisation of the natural resources rent towards enhancing the complexity of the economy reduces the public debt burden associated with these economies.

The study concludes that economic complexity and natural resources rent are significant predictors of the extent of a debt crisis in selected oil-rich SSA countries. More importantly, economic complexity and natural resources rents help in reducing the tendency towards debt crises in these countries. The study recommends greater deployment of natural resources rents for productive

purposes and the creation of a conducive investment climate so as to reduce the tendency of these fiscal authorities to contract more debts, which can lead to a debt crises. Furthermore, economies should take advantage of the returns from natural resources in diversifying the economy to deepen the complexity of the economy with respect to product sophistication and exporting networks. Despite the tendencies of natural resources rents to reduce the debt burden of these SSA oil-rich countries, it is important for these countries to contract debt for development purposes or productive purposes.

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