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EVIDENCE OF DUTCH DISEASE AND CROSS-SECTIONAL DEPENDENCE IN RENT-SEEKING SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT: *This study assessed the evidence of Dutch disease and cross-sectional dependence in resource-led growth sub-Saharan African countries economies. In an atempt to achieve this, a consistent econometric model developed by Cavalcanti, Mohaddes, and Raissi (2010) was adopted which showed that there is a long run relationship between real income, natural resource rents and export revenue from natural resource in resource-led economy in sub-Saharan African Countries. The study used Secondary data. Annual data from 1981 to 2016. The study account for cross-country dependencies (both in the properties of the data and the long-run estimation) that arise potentially from resource price shocks and other unobserved common factors, and allow countries to respond differently to these shocks. four cross-sectional dependence tests namely, Breusch and Pagan LM test (CD1), Pesaran CD test (CD2), Frees' test (CD3) and Friedman's test (CD4) where tested. The study adopted the methodology developed by Pesaran (2006) for estimation which is consistent under both cross-sectional dependence and cross-country heterogeneity. Using natural resource rent as a proxy for rent-seeking economy, the results indicated that natural resource contributed positively to real income of sub-Saharan African Countries, and cross-country dependencies is much evident among these countries.*

KEYWORDS: Dutch disease, cross-sectional dependence, rent-seeking and natural resource

INTRODUCTION

The emphasis on natural resources, rent-seeking and economic growth and development in SSA countries should factor in the possibility of cross-sectional dependence evidence among some or all SSA countries. Cross-sectional dependence exists as a result of regional integration, particularly, organization that may influence their members to exhibit certain characteristics in macroeconomic variable (Chudik & Peseran, 2013). For example, member countries in Organization of Petroleum Exporting Countries (OPEC), Economic Community of West African States (ECOWAS) The Southern African Development Community (SADC), The Inter-Governmental Authority on Development (IGAD), The Economic Community of Central African States (ECCAS) and The Arab Maghreb Union (AMU), East African Community (EAC), The New Partnership for Africa's Development (NEPAD), etc., could distort national policies, estimated budget and domestic prices.

The negative correlation found between resource abundance and dependence, and economic growth has been empirically studied using panel data analysis and cross-sectional independent homogeneity among units. Notably, Sachs & Warner (1995, 1997, 1999 and 2001) in many studies on natural resource curse used cross-sectional independent homogeneity panel data. Most studies tend to follow Sachs & Warner cross-sectional independence panel analysis with different variables to study the relationship between natural resource abundance and economic growth and development. These studies include Auty (1997), Sala-i-Martin & Subramanian (2003), Bulte, *et al* (2005), Barro & Sala-i-Martin (1991), Mankiw, Romer & Weil (1992), Ross (1999), Arellano & Bond (1991) and Arellano & Bover (1995). However, Pesaran (2004) and others have argued that cross-sectional dependence should be factored into panel data to test for the possible cross-sectional correlation among units. He noted the problem with cross-sectional independent dynamic panel data techniques, when applied to testing growth effects. Cross-sectional independence analysis can produce inconsistent and misleading estimates of the average values of the parameters, since growth models typically exhibit substantial cross-sectional dependence.

Problem of cross-sectional dependence can arise from a wide range of issues that are also relevant in SSA countries. For example, Chudik & Peseran (2013) suggested that correlation of errors could arise due to omitted common effects, spatial effects, or as a result of common socioeconomic network interaction within countries. In the issue of resource curse in SSA countries, correlation of errors could arise due to the commodity price fluctuations in international commodity market often observed among OPEC member countries. For SSA countries, the price changes may have common effects on OPEC member countries in SSA and on their budget estimations. The spatial effects can arise among countries that have similarity in geographical, topographical and demographical effects. For instance, countries that are characterized with ethnic fractionalization can exhibit correlation in their growth trends (Hodler, 2004). Common socioeconomic interactions among SSA countries can lead to cross-sectional dependence. This can be in form of regional integration pursuing the same developmental agenda and foreign policy. The New Partnership for Africa's Development (NEPAD), the Economic Community of West African States (ECOWAS), Common Wealth Nations member countries in SSA, Francophone Countries and common ties with developed countries can cause cross-correlation among cross-sectional units. All these are prevalent among SSA countries.

In this study we take a different approach in order to test the resource-led growth economy. We explicitly recognize that there is a substantial degree of cross-sectional dependence in SSA countries. Ignoring cross-dependence can have serious consequences, and the presence of some cross-sectional dependence in panel data is likely to be the rule rather than the exception as Chudik & Peseran (2013) noted. This stance is important following Ng (2004) assertion that "there is possibilities in situation when some but not necessarily all the cross-sectional units are dependent". Therefore, the presence of cross-sectional dependence in panel data is largely ignored especially in the area of natural resources (Hoechle, 2008).

These numerous issues stated eventually lead one to ask questions: Is there evidence of cross-sectional dependence on resource-led growth in resources rich sub-Saharan African countries economy? In the presence of cross-sectional dependence, can it be established if the resource curse hypothesis continues to hold or not? Therefore, this study intends to fill these gaps by accounting and examining the evidence of cross-sectional dependence in resource-led growth sub-Saharan African countries economies; hence, the study.

The objective of this study is to examine the evidence of Dutch disease and cross-sectional dependence in rent-seeking sub-Saharan African countries economies and factor in the possibility of the effect of this dependence on the resource-growth hypothesis. The data are compiled from the World Development Indicators (2017), a statistical bulletin published by

World Bank for 21 -Saharan African Countries that data are available and covers the period of 1981 to 2016.

Following this introduction, the next section reviewed the relevant literature, follow by the discussion of the theoretical framework and the methodology approach to the study, while results presentation and the discussion of empirical findings are in the next section. The last section provided the summary, conclusion and recommendations.

LITERATURE REVIEW

Dutch Disease Hypothesis

Krugman (1987) defined Dutch Disease as the apparent relationship between the increase in exploitation of natural resources and a decline in the manufacturing sector (or agriculture). The mechanism is that an increase in revenues from natural resources (or inflows of foreign aid) will make a given nation's currency stronger compared to that of other nations (manifest in an exchange rate), resulting in the nation's other exports becoming more expensive for other countries to buy, making the manufacturing sector less competitive (Torres *et al*., 2013). Rudd (1996) referred to Dutch disease as a situation when a country discovers a substantial natural resource deposit and begins a large-scale exportation of it. As a result, the country's currency appreciates, thereby reducing the competitiveness of the country's traditional export sector. Therefore, this tradable goods sector should contract, leading to structural changes and unemployment in the economy. The resulting re-allocation of resources from the high-tech and high-skill manufacturing and service sectors to the low-tech and low-skill natural resource sector is then harmful for economic growth. More recent work argues however that there is no reason for the natural resource tradable sector to provide less externality than the manufacturing sector (Wright & Czelusta 2004; Torres *et al*., 2013).

The study of natural resource curse has its root in the work of structuralist theses of the 1950s, focusing on the decline in the terms of exchange between primary and manufactured products (Prebisch, 1950), the volatility of primary product prices, or the limited linkages between the natural-resource sector and the rest of the economy (Hirschman, 1958). However, none of these explanations was confirmed by empirical tests (Corden & Neary, 1982; Neary & van Wijnbergen, 1986). Neary & Wijnbergen (1986) developed the theoretical framework for the analysis of the Dutch Disease by explaining the empirically its mechanism. The problem is how the allocation of resources and sectorial structure are affected when a resource-exporting country experiences a resource boom. More specifically, de-industrialization will occur, that is, the industrial sector will (or agricultural sector) shrink in a resource boom. As a rule, the resource country is modeled to consist of three sectors, namely the resource sector, another exporting sector (industry) and a non-tradable sector.

The resource boom raises national income, and demand for the non-tradable increases in the process, drives up the price of the non-tradable. The theory assumed a small country case with a constant price of the tradable, the relative price of the non-tradable rises (that is, an appreciation of the real exchange rate); production of non-tradables increase whereas output of manufacturing falls. The theory identifies the two components or effects of Dutch Disease: the spending effect and the resource-movement effect. The spending effect implies de-industrialization and a real appreciation. The second effect operating is the resource-moving effect. The resource sector and

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eventually the non-tradable sector attract resources which are withdrawn from manufacturing. In the “specific factor” model it is assumed that one factor (capital) is specific to each sector in the short-run whereas the other factor (labor) is mobile. The wage rate is flexible. The resource movement effect reinforces de-industrialization and a real appreciation. Since both the relative price between non-traded and traded goods and the wage rate rise, output in the non-traded sector may rise or fall.

Historical Background of Cross-sectional Dependence

The concept of cross-sectional dependence has its root in the work of O’Connell (1998). His work introduced a new methodology in panel data analysis that captured the power gain of panel over univariate root test and feasible Generalized Least Square (GLS) corrections to deal with cross sectional dependence. He was the first author to note that cross-sectional correlation in panel data will have negative effects on the panel unit root test, making the test have substantial size distortion and low power. Though Im, Pesaran and Shin (1997) proposal of subtracting cross sectional means from the observed data would have given credence to cross-sectional dependence, but their procedure provided that cross sectional dependence is of weak memory variety. Many studies attempted to develop the issue of cross-sectional dependence among others are Banerjee (1999), Maddala & Wu (1999), Cerrato (2001), Bai (2001) and Chang (2001). Also Bai & Ng (2004), Moon & Perron (2004), and Phillips & Sul (2003) make use of residual factor models to take account of the cross-section dependence.

It was not until Peseran (2004) gave a detailed and simple method to test cross-sectional dependence which is applicable to a variety of panel data. His proposed tests, called the CD test, are based on average of pair-wise correlation coefficients of the Ordinary Least Square (OLS) residuals from the individual regressions in the panel, and can be used to test for cross section dependence of any fixed order p, as well as the case where no a *priori* ordering of the cross section units is assumed. His test is correctly centered for fixed N and T (also in the case of small T), and are robust to single or multiple breaks in the slope coefficients and/or error variances. Peseran his credited with many studies in different dimensions in this area (Peseran, 2004, 2007 and Chudik & Pesrean, 2013; Baltagi & Peseran 2007).

Prior to Peseran new test of cross-sectional dependence, there are some existing tests that previous studies used. These alternative approaches to testing for cross-sectional dependence in panels are namely: testing for spatial correlation pioneered by Moran (1948) and the Lagrange multiplier approach of Breusch & Pagan (1980), Peseran (2004) identified in his study. In Hoyos & Sarafidis work (2007), Friedman's (1937) test statistic proposed, called the Frees and Friedman test of cross-sectional dependence was also used. The testing for cross-sectional dependence is shown to be important in estimating panel data models and many recent studies using panel data have factored in the cross-sectional dependence tests. From this status quo, evidence of cross-sectional dependence is reviewed below.

Evidence of Cross-sectional Dependence in Panel Analysis

More recent studies of the panel data literature come to the conclusion that panel data sets are likely to exhibit substantial cross-sectional dependence, which may arise due to the presence of common shocks and unobserved components that become part of the error term ultimately, spatial dependence, as well as due to idiosyncratic pair-wise dependence in the disturbances with no particular pattern of common components or spatial dependence (Pesaran, 2004). Hoyos & Sarafidis (2007) noted that one reason for this development may be that during the last few decades we have experienced an ever-increasing economic and financial integration of countries and financial entities, which implies strong interdependencies between cross-sectional units. In microeconomic applications, the propensity of individuals to respond to common shocks or common unobserved factors in a similar manner may be plausibly explained by social norms, proximity effects, same behavioural pattern and what is referred by Hoyos & Sarafidis as 'genuinely interdependent preferences'.

Unobserved common factors cannot be silenced in panel data. Beckmann, Belke & Dobnik (2011) argued that these unobserved common factors are as a result of common ties among cross countries. The impact of cross-sectional dependence in estimation naturally depends on a variety of factors, such as the magnitude of the correlations across cross-sections and the nature of cross-sectional dependence itself (Peseran 2007; Hoyos & Sarafidis, 2007). Hoyos & Sarafidis (2007) assumed that cross-sectional dependence is caused by the presence of common factors, which are unobserved (and as a result, the effect of these components is felt through the disturbance term) but they are uncorrelated with the included regressors, the standard fixed-effects (FE) and random effects (RE) estimators are consistent, although not efficient, and the estimated standard errors are biased. In this case, as they noted, different possibilities arise in estimation. Furthermore, Phillips & Sul (2003) showed that if there is sufficient cross-sectional dependence in the data and this is ignored in estimation (as it is commonly done by researchers) the decrease in estimation efficiency can become so large that, in fact, the pooled least squares estimator may provide little gain over the single equation OLS.

Beckmann *et al,* (2011) observed however, that 'first generation' panel root unit and cointegration tests have been heavily criticized because they assumed that the cross countries are independent. These so-called 'second generation' panel unit root tests are also reviewed in Choi (2006) that factored in cross-sectional dependence evidence in panel data analysis. Olayeni & Tiwari (2014) agreed to this in their study and utilized the 'second generation' panel unit root tests rather than the 'first generation' panel unit root tests that do not factor in cross-sectional dependence. Peseran (2004) formulated a model to test for spatial dependence which is referred to as the p^{th} order spatial dependence test. The order p measures the extent of local dependence, and specifies the number of contiguous layers of neighbours that i^{th} cross section unit depends on. The structure of dependence among cross units can be related to location and distance, both in a geographic space as well as more general economic or social network space (Batalgi & Peseran, 2007).

Ng (2004) analyzed data on industrial production among 12 OECD countries, as well as 21 real exchange rates. The evidence favors a common factor structure in European real exchange rates but not in industrial production. The study concluded that since a common factor exists in European real exchange rates and but not in real output, the evidence of cross-sectional dependence points to the presence of a nominal or monetary factor. Peseran (2007) applied CD test to a panel of 17 OECD real exchange rate series as well as to log real earnings of households. The paper presents a new and simple procedure for testing unit roots in dynamic panels subject to (possibly) cross-sectional dependent as well as serially correlated errors. The CD test was statistically significant for the sample as a whole, suggesting a reasonable degree of cross-sectional dependence among cross section units. Chudik & Peseran (2013) applied CD test in

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their study and provided a brief account of the concepts of weak and strong cross-sectional dependence, and discuss the exponent of cross-sectional dependence that characterizes the different degrees of cross-sectional dependence. Cavalcanti, Mohaddes & Raissi (2011) study is found to be the only close empirical findings of cross-sectional dependence on oil production among oil-rich countries. The study carried not only cross-sectional dependence but also panel unit root test, cointegration and panel error correction model in their analysis. They recognized that there is a substantial heterogeneity and cross-sectional dependence is consisted in the sample employed. So it is important to identify unobserved common factors that may characterized natural resource curse in SSA countries.

METHODOLOGY

The challenge facing the empirical literature on growth and development, and natural resource abundance, dependence and curse is the lack of applied theoretical framework derivation of the econometric model that is being tested. As noted by Cavalcanti *et al.* (2011), either an *ad hoc* approach is used, in which output growth is regressed on selected independent variables arbitrary chosen, or theoretical model is developed. However, the econometric model specified is unconnected to the theoretical background when estimating. The theoretical model for panel data econometric test suited for this study was developed by Cavalcanti *et al.* (2011) as a necessity to see whether the resource curse is in fact present in our sample considering the heterogeneous nature of the cross-sectional units and their dependence or possible correlations that may exist among them. Hence the econometric model and methodology are derived from it suggesting a long-run relationship between the value added of manufacturing output, government expenditure, natural resource rents and real GDP growth rates (all variables in per capita), and between real GDP growth rates, natural resource rents and the share of natural resource export in total merchandize export proxy by total merchandized exports. This study will explicitly adopt the CMR (Cavalcanti Mohaddes and Raissi) theory of natural resource theory to expressly explain the resource curse hypothesis which is consistent with the long-run model. The CMR model is as follow.

The CMR Model for Natural Resource

The model assumed that a representative firm uses physical capital, *K(t),* labor, *L(t),* and natural resources, *NR(t),* to produce the consumption good, *Y(t),* according to the following production function:

$$Y(t) = K(t)^{\alpha_1} NR(t)^{\alpha_2} \left(A(t)L(t)\right)^{1-\alpha_1-\alpha_2}, \alpha_1, \alpha_2 > 0 \ \alpha_2 + \alpha_2 < 1 \qquad 1$$

where $A(t) = A(0)e^{gt}$ is the labor augmenting technical progress, and *A(0)* is an economy specific initial endowment of technology (see prove in Cavalcanti *et al.*, 2011).

Econometric Model

As Cavalcanti *et al.* (2011) noted, the theoretical model derived suggest a long run relationship among variables. This study digressed from specific variables used in their study by using real GDP as the dependent variable and target variables, namely: resource export revenue and resource and instrumental variables, namely: net investment, trade openness and inflation rate. The study adopted the Common Correlated Effects (CCE) type estimators developed by Pesaran

(2006). The estimator eliminate cross-sectional dependence (CD) asymptotically, both strong and weak forms. The study also perform first generation unit root tests of Im, Pesaran & Shin , IPS, (2003) and second generation unit root tests of Peseran' CIPS test (Peseran, 2007) and on the variables employed in this studies. The second generation unit root tests are robust to cross-sectional dependence which has been verified to be more powerful than the first generation unit root test that assumes cross-sectional independence (Olayeni & Tiwari, 2014; Hurlin, 2004). Pesaran (2004) cross-sectional dependence test will be carried on all the variables under study. If there is cross-sectional dependence in the variables, standard panel unit root test, IPS is not valid and the CIPS, will be consider to be valid. This study adopted cointegration tests proposed by Pedroni's, 1999, 2004, (Engle-Granger based) and Kao, 1999, (Engle-Granger based) Residual cointegration tests for the null hypothesis of no cointegration to the residuals, u_{jt} from the ARDL Dynamic panel data model for all models. The models are expressed as follows:

Presenting a Long-run Manufacturing functional relationship

drv = *f*(gep, nrr, gdp) 2

where drv is value added Manufacturing output (Dutch disease), gep is Government expenditure, nrr is Natural resource rents, gdp is Gross Domestic Product and *f* is functional notation. For the purpose of statistical test, the log linear representation of (8)a is thus:

$$\ln drv_{it} = \beta_{1i} + \beta_{1i} \ln gep_{it} + \beta_{2i} \ln nrr_{it} + \beta_{3i} \ln gdp_{it} + \mu_i + \in_{it} \quad i = 1,2,,...,N; t = 1,2,...,T \qquad 3$$

Where $lndrv_{it}$ is the natural log of real manufacturing's contribution to GDP per capita over period t in generic country i, $ln(gep)_{it}$ is the natural log of government expenditures per capita, $In(gdp)_{it}$ is the natural log of current Gross Domestic Product per capita as a control variable and $In(nrr)_{it}$ is the natural log of natural resource rents per capita over the cross countries and time periods. With β_{i0} denoting country specific fixed effects. From the CMR model, the econometric specification does not imposed homogeneity of the depreciation rate, $\delta_{i,}$ or the growth rates of labour, $n_{i,}$ and technology, g_i, which is accommodated through the fixed effects. μ_i which is the error term, capture the individual cross-sectional units unobserved effects. The idea behind the per capita value to all variables is to capture growth in per capita terms that expresses the economic growth.

If the variables are *I(1)* and cointegrated, then the error term is *I(0)* for all *i*. The ARDL (1,1,1) dynamic panel specification of (8) of the study is

$$\begin{aligned} ldrv_{it} &= \alpha_{01i} + \alpha_{10i} \lg ep_{it} + \alpha_{11i} \lg ep_{it-1} + \alpha_{20i} \ln rr_{it} + \alpha_{21i} \ln rr_{it-1} + \alpha_{30i} \lg dp_{it} + \lambda_i ldrv_{i,t-1}\mu_i + \in_{it} \\ i &= 1,2,,...,N; t = 1,2,...,T \end{aligned} \qquad 4$$

The error correction reparameterization of (9) is

$$\begin{aligned} \Delta ldrv_{it} &= \Phi\left(ldrv_{i,t-1} - \beta_{0i} - \beta_{1i} \lg ep_{it} - \beta_{2i} \ln rr - \beta_{3i} \lg dp\right) + \alpha_{11i} \Delta \lg ep_{it-p} + \alpha_{21i} \Delta \ln rr_{it-p} + \\ &\alpha_{31i} \Delta \lg dp_{it} + \varphi_i \Delta ldrv_{i,t-1} + \in_{it} \end{aligned} \qquad 5$$

where

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$$\Phi_i = -(1-\lambda_i), \beta_{0i} = \frac{\mu_i}{1-\lambda_i}, \beta_{1i} = \frac{\alpha_{10i}+\alpha_{11i}}{1-\lambda_i}, \beta_{2i} = \frac{\alpha_{20i}+\alpha_{21i}}{1-\lambda_i} \, and \beta_{3i} = \frac{\alpha_{30i}+\alpha_{31i}}{1-\lambda_i} \qquad 6$$

The error-correction speed of adjustment parameter, Φ_i, and the long-run coefficients, β_{1i}, β_{2i} and β_{3i} are of primary interest. With the inclusion of β_{0i}, a nonzero mean of the cointegrating relationship is allowed. One would expect Φ_i, to be negative if the variables exhibit a return to long-run equilibrium which corrects the error associated in short-run across countries. The above long-run functional relationship, ADRL Dynamic Panel Data model and Error Correction Models will be used for all the 21 SSA countries under study (ALL), 12 resource dependent SSA countries (RD) and 9 non-resource dependent SSA countries (NRD).

Cross-Sectional Dependence Test

We therefore recognized the presence of dependence in panel data which considers different dynamics for each country in SSA that arise potentially from multiple common factors, and we allow the individual responses to these factors to differ across countries. To address the issues raised above we use four CD tests namely: Breusch & Pagan (1980) LM test (CD1), Pesaran (2004), for testing the extent of cross-sectional correlation of panel residuals on resource curse among SSA countries (CD2), the frees' test (CD3) and the Friedman's test (CD4). These tests are relevant as many studies have employed it in their panel analysis in different dimension, notably, Hoyos & Sarafidis (2007), Cavalcanti *et al*, (2011) and Olayeni & Tiwari (2014). Therefore, the essence of modeling and explaining the cross-sectional dependence of errors on resource curse in SSA countries is an important issue.

RESULTS AND DISCUSSIONS

Unit Root Tests

It is important to make sure that there is no mixture of I(0), I(1) and I(2) variables so that we make sensible interpretation of the long-run relationships. Therefore panel unit roots tests is of very importance. It has been observed that the second generation unit root tests are robust to cross-sectional dependence which has been verified to be more powerful than the first generation unit root test that assumes cross-sectional independence (Olayeni & Tiwari, 2014; Hurlin, 2004). This study recognized this position and employed two parallel unit roots tests. The first generation unit root test includes Im, Pesaran and Shin, 2003, (IPS) unit roots test and the second generation unit root test, Peseran (2007) cross section averages of Cross-sectional Augmented Dickey-Fuller (CADF(*p*)) test statistics, refer as CIPS panel unit root test. Cross-sectional dependence test of Pesaran (2004) on each of the variable at level lagged values and at first difference is reported.

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Table 1: First and Second Generation Unit Root Tests and CD Test for All Sub-Saharan African Countries Variables

Variables	IPS Test	Pesaran's CIPS Test			CD Test
I(0)	**Lag(0)**	**Lag(0)**	**Lag(1)**	**Lag(2)**	
$lndrv_{it}$	-1.51	-1.917	-2.059*	-1.804	22.68***
$lngep_{it}$	-1.15	-2.114*	-1.968	-1.697	31.96***
$Innrr_{it}$	-0.88	-1.947	-1.911	-1.804	50.85***
$Ingdp_{it}$	-0.62	-2.223**	-2.328***	-1.944	47.10***
$Inmex_{it}$	-0.84	-2.595***	-2.336***	-1.951	43.33***
I(1)					
$\Delta lndrv_{it}$	-4.81***	-5.037***	-4.100***	-3.043***	18.77***
$\Delta lngep_{it}$	-5.13***	-5.366***	-4.169***	-2.942***	14.04***
$\Delta Innrr_{it}$	-5.00***	-5.310***	-3.743***	-3.146***	32.02***
$\Delta Ingdp_{it}$	-4.74***	-5.209***	-4.158***	-3.190***	25.07***
$\Delta Inmex_{it}$	-5.61***	-5.317***	-4.137***	-3.244***	14.58***

Source: Author's calculation, 2018. **Notes**: *Δ* Symbolizes first difference of variable. Significant at *10%, ** 5% and ***1% levels for all statistics. IPS test statistic at 1, 5, and 10 percent are -1.979, -1.844 and -1.774 respectively; Pesaran's (CIPS) test (2007) critical value at 1, and 10 percent, respectively, are -2.300, -2.160 and -2.080. The CD test is Pesaran (2004) cross-sectional dependence test.

Table 1 reported the IPS and the CIPS unit root tests for all SSA variables under study. These variables are log of value added manufacturing output to GDP per caipta, log of governments expenditure per capita, log of natural resource rents per capita, log of GDP per capita and log of total merchandized exports per capita. The Akaike information criterion was used to select the number of lags. No lag for IPS test on all variables was appropriate, and all variables was stationary at first difference at 1% level after showing non-stationarity at level at 1% level. Cross sectional dependence of the residuals from the ADF(p) regressions of the log of value added manufacturing output to GDP per caipta, log of governments expenditure per capita, log of natural resource rents per capita, as well as log of GDP per capita and log of total merchandized exports per capita and their first differences, over the period 1981 to 2012 across all of the 21 countries was reported. The reported CD statistics are highly significant at 1% level of significance, with the natural resource rents variable displaying very large test statistics. The presence of the cross sectional dependence implies that the use of standard panel unit root tests, such as the IPS test proposed by Im *et al.,* (2003) are not valid (Cavalcanti *et. al.,* 2009).

On the basis of Pesaran (2004) CD test, Pesaran's CIPS test will be appropriate to consider. This test follows the Common Correlation Estimate of cross- errors approach among cross countries and filters out the cross section dependence by augmenting the ADF regressions carried out separately for each country with cross section averages. The CIPS test included lag orders of variables, lag 0, 1, and 2, from which it is clear that only log of value added manufacturing output per capita and log of natural resource rents per capita are non-stationary at lag 0 at 1% level. Log of government expenditure per capita is not significant at 10% level at lag 0 but, significant at 1% level at lag 1 and 2. We reject the null hypothesis of no stationarity for log of GDP per capita and log of total merchandized exports per capita at lag 0 and lag 1 at 5% level and accept the null hypothesis of non-stationary at lag 2 at 1% level. The reason behind the lagged variables is to have uniformity in the order of integration. Thus, we can safely regard all the variables as being

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I(1) and not worry about dealing with a mixture of I(1) and I(2) variables in our model. For all of our variables, log-level and without a trend is estimated. The unit root hypothesis is clearly rejected at the 1% level, and for all variables and for all statistics at their first difference. The implication of these results for different stationarity test in CIPS across variables in their lags value demands that the ADRL dynamic panel model to be estimated should include lag variables according to their lag specification. For instant, in model 2, the lag for total merchandized exports to be used should be at lag 2 because it is stationary at lag 1 in CIPS test. This consideration of lag selection in the models will give a robust and consistent estimation.

Cointegration Tests

Table 2: Cointegration Tests

Model	Panel rho	Panel PP	Panel ADF	Group rho	Group PP	Group ADF	Kao
All	-0.34	-7.77***	-8.38***	1.75	-8.52***	-7.82***	-23.40***
RD	-0.419	-6.286***	-6.829***	0.958	-8.408***	-7.661***	-18.31***
NRD	0.24	-3.89***	-4.11***	1.57	-3.30***	-3.10***	-12.45***

Source: Author's calculation, 2018. **Notes**: significant at *10%, ** 5% and ***1% levels for all statistics. Md1 All means model 1 for all SSA, Md1 RD means model 1 for resource dependent SSA, Md1 NRD means model 1 for non-resource dependent SSA, Md2 All means model 2 for all SSA, Md2 RD means model 2 for resource dependent SSA, Md2 NRD means model 2 for non-resource dependent SSA.

The cointegration test result reported in Table 2 is based on the ADRL Dynamic Panel Data (DPD) model specified in equations (9) and (13), which considered the lag criterion of the panel unit roots test conducted in this study. As it is clear from table 1 that after first difference, all variables are stationary at integration of order of 1 after selection of appropriate lags. The Pedrono's residual cointegration test has 7 statistics of which 6 is adopted. The first, the 'panel rho-statistic', is a panel version of a nonparametric statistic analogous to the known Phillips and Perron (1988) rho-statistic. The 'panel *t*-statistic', a nonparametric, is the second similar to the Phillips and Perron *t*-statistic. The third, the 'panel *t*-statistic is a parametric statistic analogous to the known ADF *t*-statistic. These cointegration tests are refer as within-dimension tests. The other three in Pedroni's cointegration test are refer as the between-dimension test and are based on a group mean approach that has the capacity to take care of cross-sectional dependence in models. The 'group rho-statistic' is the first, is analogous to the Phillips and Perron rho-statistic. The second, the group *t*-statistic is a nonparametric statistic similar to Phillips and Perron *t*-statistic and the last is the 'group *t*-statistic (parametric)', is analogous to the ADF *t*-statistic. The other conitegration, the Kao residual based conitegration test will also be reported which is an ADF-type.

In All, it showed that the null hypothesis of no cointegration is rejected at 1% level of significance in 5 statistics and non-significance in panel rho-statistic and group rho-statistic. The same result is also reported for RD and NRD. Therefore, the assumption that the long-run parameters for the variables in their levels are equal to the short-run parameters for the variables in their differences and they showed a strong evidence of cointegration relation. This suggest that there is long-run equilibrium relationship that exist between log of value added manufacturing output per capita and log of government expenditures per capita , log of natural resource rents per capita and log of GDP per capita.

Long-run Level Estimation, ADRL Dynamic Panel Fixed Effects Model

Table 3: Long-run Level Estimations

$ldrv_{it}$	**All**	**RD**	**NRD**
Constant	-0.260** (0.127)	-0.043 (0.189)	-0.828*** (0.156)
$lngep_{it}$	0.278*** (0.036)	0.277*** (0.047)	0.215*** (0.056)
$Ingdp_{it}$	0.164*** (0.035)	0.081* (0.047)	0.457*** (0.055)
$Innrr_{it}$	0.029** (0.013)	0.031** (0.015)	0.053* (0.033)
$Innrr_{it-1}$	-0.037*** (0.013)	-0.035**(0.015)	-0.122*** (0.034)
$lndrv_{it-1}$	0.785*** (0.022)	0.777*** (0.030)	0.699*** (0.033)
$lngep_{it-1}$	-0.249*** (0.033)	-0.185*** (0.045)	-0.338*** (0.045)
R^2	0.9729	0.9650	0.9745
F-stat	557.89***	236.60***	552.02***
CD 1	327.22***	80.96*	54.81**
CD 2	10.62***	3.71***	4.22***
CD 3	0.40***	0.15**	0.13**
CD 4	119.93***	70.69***	50.19***

Source: Author's calculation, 2018. **Notes**: $\Delta(ldrv_{it})$ is dependent variable for model 1 and $\Delta(lgdp_{it})$ is dependent variable for model 2. Significant at *10%, ** 5% and ***1% levels for all statistics; standard error in parenthesis. CD 1, 2, 3 and 4 are Breusch & Pagan (1980) Langrange Multiplier test, Pesaran (2004) CD test, Frees (1995, 2004) CD test and Friedman (1937) test respectively for cross-sectional dependence tests. All means All 21 SSA, RD means 12 resource dependent SSA and NRD means 9 non-resource dependent SSA.

In Table 3, the results reported all SSA countries, RD SSA countries and NRD SSA countries. The variables employed are log of value added manufacturing output per capita (lndrv), as dependent variable, depending on log of government expenditure per capita (lngep), log of natural resource rents per capita (lnnrr) and log of GDP per capita (lngdp), as a control variable. This model is specified to assess the evidence of Dutch disease and cross-sectional dependence in SSA countries. The estimated method, ADRL Dynamic Panel Data model, allows for lagged values of the dependent variable, $ldrv_{it-1}$ and some of the independent variables. Therefore in this case, the lagged values of dependent variables selected based on integration of order p identified in the panel unit roots tests are $Innrr_{it-1}$ and $lngep_{it-1}$.

From the results, All SSA countries, in Table 3, it showed that lngep (*t-stat* = 7.68), lngdp (*t-stat* = 4.75), $lndrv_{t-1}$ (*t-stat* = 35.62), $lngep_{t-1}$ (*t-stat* = -7.59) and $lnnrr_{t-1}$ (*t-stat* = -2.91) are significant at 1% level of significance, except lnnrr (*t-stat* = 2.28) at 5% level of significance. At no lag, the coefficients of independent variables are positive. This implies that a positive change in lngep at current time, lndrv will respond positively at elasticity value of 0.28, while a proportional increase in lnnrr will increase lndrv, inelastically, by 0.03. The control variable coefficient, lngdp, has a positive value which implies that ldrv and lgdp has a positive relationship. Therefore, any significant proportional change in lngdp, ldrv will respond by 0.16. The distributive lag of lngep and lnnrr with lag 1 has a negative relation with ldrv with elasticity values -0.037 and -

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0.249 respectively, are inelastic to lndrv. It is obvious form the estimated result that past value of government expenditure and natural resource rents have negative effect on value added manufacturing output. This results show that Dutch disease and rent seeking in SSA countries are evidence not on current values but on past values. The findings explain that SSA countries manufacturing sector will not decline as a result of increase in natural resource production nor firms engagement on rent seeking immediately, but will later in the nearest future deteriorate.

It is also reported in Table 3 in All SSA countries column correlation coefficient that measure the goodness of fit is high, valued at 0.9729. It indicates that ldrv is explained by the independent variables by 97.3%, and the overall statistic, F-statistic value at 5557.89, is significant at 1% level of significance. The estimated model tests carried out showed a strong evident cross-sectional dependence (CD) at 1% level of significance for all CD tests. The 4 CD tests are Breusch & Pagan LM test (CD1 = 54.81), Pesaran CD test (CD2 = 4.22) Frees test (CD3 = 0.13) and Friedman test (CD4 = 50.19). These CD tests results support the claim of Cavalcanti *et al.* (2011) of substantial cross-sectional dependence among oil-rich countries. The unobserved common factors is evident among SSA countries and it is as a result of integrated social networks, interrelations, policy interaction and policy shocks that are imperative among developing economies.

Acknowledging the non-stationary of the variables at their lag specifications, and their stationarity at first difference and establishing panel cointegration in all models, the Panel Error Correction Model (PECM) can be estimated. As identified earlier, the purpose of the PECM is to correct the error associated in short-run across countries. The coefficients of lagged value of errors must be negative to cause a return to long-run equilibrium.

Panel Error Correction Model (PECM)

Table 4: PECM

$\Delta(ldrv_{it})$	**All**	**RD**	**NRD**
Constant	-0.009 (0.007)	-0.009 (0.011)	0.005 (0.007)
$\Delta(lngdp_{it})$	0.703*** (0.058)	0.569*** (0.089)	0.986*** (0.067)
$\Delta(lngep_{it})$	0.089** (0.037)	0.137*** (0.048)	-0.092* (0.055)
$\Delta(lnnrr_{it})$	0.002 (0.012)	0.008 (0.015)	0.017 (0.038)
$\Delta(lndrv_{it-1})$	0.496*** (0.094)	0.553*** (0.130)	0.384*** (0.086)
$\Delta(lnnrr_{it-1})$	-0.007 (0.012)	-0.008 (0.015)	0.068** (0.030)
$\Delta(lngep_{it-1})$	-0.144*** (.043)	-0.140*** (0.055)	-0.124** (0.054)
et_{it-1}	-0.705*** (0.101)	-0.813*** (0.140)	-0.454*** (0.104)
R^2	0.4254	0.3669	0.6580
F-stat	61.20***	27.11***	68.25***
CD 1	272.55***	78.27	39.62
CD 2	5.40***	2.12**	2.41**
CD 3	0.15**	0.10*	-0.02
CD 4	76.55***	52.99***	37.48***

Source: Author's calculation 2018. **Notes**: $\Delta(ldrv_{it})$ is dependent variable for model 1 and $\Delta(lgdp_{it})$ is dependent variable for model 2. Significant at *10%, ** 5% and ***1% levels for all statistics; standard error in parenthesis. CD 1, 2, 3 and 4 are Breusch & Pagan (1980) Langrange Multiplier test, Pesaran (2004) CD test, Frees (1995, 2004)

CD test and Friedman (1937) test respectively for cross-sectional dependence tests. All means All 21 SSA, RD means 12 resource dependent SSA and NRD means 9 non-resource dependent SSA.

The PECM estimates is of great importance because it shows the short-run relationships of variables. All the coefficients of error terms as independent variable in all models have negative slopes and are significant at 1% level. This suggest that the error associated in short-run across countries has been corrected, and there is a return to long-run equilibrium.

The short run estimates for All SSA countries showed that lnnrr, with positive slope of 0.002 (*t*-stat = 0.20), and it's lagged value, with negative slope of -0.007 (*t*-stat = -0.54), are not significant. However, lngep, with a positive slope of 0.089 (*t*-stat = 2.43), and it's lagged value, with a negative slope of 0.144 (*t*-stat = -3.35), are significant with 5% and 1% level of significance respectively. This implies that in the short run, natural resource rents does not have any significant impact on manufacturing output, therefore evidence of rent-seeking cannot be established in SSA countries in the short-run. This is not the case of Dutch disease. The spending effect due to increase in production of natural resource prove to have positive impact on manufacturing at current period relationship, but negative relationship on past values of government expenditures. On the basis of past value of government expenditure, we can establish that the hypothesis of Dutch disease is evident in SSA countries in the short run and in the long run relationships. The dynamic factor of lagged value of the lndrv with coefficient of 0.50 (*t*-stat = 5.30) is positively significant at 1% level of significance as well as the control variable, lngdp with coefficient of 0.70 (*t*-stat = 12.02), is significant at 1% level of significance.

CONCLUSION

This study focus to establish the evidence of Dutch disease and cross-sectional dependence as well determine the relationship between rent-seeking and manufacturing sector which explain the resource curse hypothesis. The study established a long-run relationship between the variable in the models. It was empirically observed that in the long-run relationship the evidence of Dutch disease could not be established when manufacturing output depends on the current values of government expenditure and natural resource rents. Empirically, government expenditure and natural resource rents affect manufacturing output positively in all SSA countries. However, the inclusion of lagged values of government expenditure and natural resource rents established the evidence of Dutch disease and rent seeking in the region. These findings showed that in the absence of strong socio-political institutions and good policy-driven economic growth, the manufacturing sector will be declining to obscurity. As identified by Lundgren, Alun & York (2013), forward and backward linkages from primary exports to the rest of the economy are weak and that upward pressure from a surge in resource receipts on the nominal exchange rate and on prices leads to a broader loss of international competitiveness and, as a result, a reduction in manufacturing output and employment which will bring about the Dutch disease syndrome.

Problem of cross-sectional dependence was identified. It was empirically found that there is a strong evidence of cross-sectional dependence among all groups of SSA under study. Though in the case of non-resource dependent SSA Countries, substantial cross-sectional dependence could not be established in manufacturing-led economy. As Chudik & Peseran (2013) suggested that correlation of errors could arise due to omitted common effects, spatial effects, or as a result of common socioeconomic network interaction within countries. In the issue of resource curse in SSA countries, there was all indication of correlation of errors that arise due to the commodity price fluctuations in international commodity market often observed among OPEC member countries. Common socioeconomic interactions which are prevalent among SSA countries in the form of former colonies attributed to the cross-sectional dependence in the region. Therefore, having established that there is a substantial evidence of cross-sectional dependence among SSA countries, the real issue hinges on how it can be factored out to avoid it causal effect on resource-led growth economy. Therefore, to address the issues of resource revenue misappropriation, weak institutions and decline in manufacturing sector, government should ensure that resource rents are not captured by selfish interests or misappropriated and government should be accountable and transparent in its resource allocation. Also, sub-Saharan African countries should endeavor to build a strong synergy through viable foreign policies that will develop their economies.

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Appendix I: sub-Saharan African Countries

The below table shows the Sub-Sahara African Countries selected for this study, and their basis of selection depends availability of data for all variables.

S/n	SSA Country	Major Natural Resource(s)
1.	Botswana	Mineral resources, Oil
2.	Burkina Faso	Mineral resources
3.	Cote d’Ivoire	Mineral resources and Agricultural materials
4.	Chad	Oil and Agricultural materials
5.	Democratic Republic of Congo	Oil, Mineral resources
6.	Central Republic of Africa	Mineral resources
7.	Ghana	Mineral resources, Agricultural materials
8.	Kenya	Mineral resources
9.	Lesotho	Mineral resources
10.	Malawi	Mineral resources
11.	Niger	Mineral resources
12.	Mauritius	Mineral resources
13.	Nigeria	Oil, Mineral Resources, Agricultural materials
14.	Rwanda	Mineral resources
15.	Senegal	Mineral Resources
16.	South Africa	Mineral resources
17.	Sudan	Mineral resources
18.	Swaziland	Mineral resources
19.	Zambia	Mineral Resources
20.	Zimbabwe	Mineral resources
21.	Congo Republic	Oil, Mineral Resources

Author’s compilation.