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The Role of Natural Resources Endowment in the African Economies' Economic Growth-Capital Flows Nexus

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Abstract. This article examines the role of natural resource endowment in the economic growth-capital flows nexus in African economies. Utilizing the system generalized method of moments (GMM) approach and Westerlund regression approaches suitable for cointegration estimation of panel data, from 54 African countries over the time frame from 2012 to 2020. Considering the joint influence of natural resource and flows of capital on economic growth. We found that there is a resource threshold beyond which natural resources either amplify or mitigate the effects of capital flows on growth in the continent. For example, in order for capital flows to have a positive long-run influence on economic growth in African countries, natural resource rent levels must be at least 2.04 turning point (threshold). This means, the positive impact of capital flow on economic growth dependent on natural resources extractions in African countries. Finally, human capital has significant long-term spill-over impact on economic growth in African economies based on the results of Westerlund cointegration tests, and with a marginal effect of 9.67 threshold as obtained using system GMM. Thus, policymakers should focus on strategies and policies aimed at developing human capital in the continent to reduce the continent's high level of reliance on natural resource extraction which will subsequently leads to protection of the environment from degradation.

1. Introduction

In recent decades, Africa's capital flows have been restructured, with financial markets liberated to encourage growth. Despite plans and initiatives to free up capital flow in Africa, it remains low and has little direct effect on growth [1, 2]. Ceteris paribus, a continent or country with natural resources would have experience capital flow than one with few or none. In reality, holding every aspect that affects capital flows is impossible due to the resource curse in Africa. This research is based on the resources curse theory, which state that resource-rich nations have slower economic growth than resource-poor ones [3-10].

As many economists have noted, capital flows from emerging to developed countries and from rich to poor countries affect growth [11-17]. This study evaluate the validity of Dunning's Investment Development Path (IDP) theory of Capital Flow [18], which holds that capital flows in stages and is influenced by either location or resources [19]. And resources curse theory expanded by by Sini, Abdul-Rahim [10].The earlier studies on natural resource-growth nexus [20, 21], found that natural resource-rich economies have poor economic growth when other variables remain constant. Also, Carkovic and Levine [22] discovered that FDI does not affect long-term growth using GMM estimator and panel dataset averaged over seven 5-year periods between 1960 and 1995. More so, Li and Liu [23] and Vu and Noy [24] found capital flows have a positive impact on growth via human capital.This study answers these questions. Do natural resources affect the capital-growth nexus? And the main objective of this paper is to examine the role of natural resources(oil, natural gas, and mineral rents) in mediating the impact of capital flows on growth. The remaining part of the paper is organised as follows; part two furnishes literature review. The third section discusses the empirical methods and data utilised in the study. fourth section avails the empirical findings.While the final section which is five, presents the conclusions and policy implication of the study.

2. Materials and Methods

2.1. Data

Data is sourced from database of World Development Indicators, [1]. A sample of 54 African nations between 2010 and 2020 was deployed.

2.2. Empirical Methodology

This study used an endogenous growth model by Romer [25]; River-Batiz and Romer [26] and widely used by researchers like Aisen and Veiga [27].We modify the model to include natural resources and other control variables.

$$RGDPC_{i,t} = \varphi RGDPC_{i,t-1} + \gamma_1 CAPFL_{i,t} + \gamma_2 NATRR_{i,t} + \gamma_3 INVET_{i,t} + \gamma_4 HUCAP_{i,t} + \gamma_5 POPGR_{i,t} + \eta_i + \mu_t + \varepsilon_{i,t} \qquad \text{eqn(1)}$$

Where i and t denotes country and period respectively. Real gross domestic product per capita is $RGDPC$, $CAPFL$ is capital flow proxy by FDI inflow, $NATRR$ represent the natural resources, $INVET$ denotes domestic investment, $HUCAP$ signifies the human capital, $POPGR$ is population growth rate. While μ_t η_i, and ε_{it} are the time effect, country-specific effect, and stochastic term respectively.The non-linear modelling of the impact of natural resources on capital-growth regression This is captured in equation(2) below.

$$RGDPC_{i,t} = \varphi RGDPC_{i,t-1} + \delta_1 CAPFL_{i,t} + \delta_2 NATRR_{i,t} + \delta_3 INVET_{i,t} + \delta_4 \left(CAPFL_{i,t} * NATRR_{i,t}\right) + \delta_5 POPGR_{i,t} + \eta_i + \mu_t + \varepsilon_{i,t} \qquad \text{eqn(2)}$$

2.3 Procedure of Estimation

We deployed the system GMM estimation technique stipulated by Blundell and Bond [28] and expanded by Sini, Abdul-Rahim [10] and [19], a stable, effective estimator that addresses poor instruments. To increase study's dependability, we present an estimation using first-and-second-generation unit root tests, cross-sectional dependency test, and Westerlund cointegrations ECM tests. For the system GMM, we reported the p-value for overidentifying limitations and second order autocorrelations, respectively, as a diagnostic test of the validity of the instruments and autocorrelation issues. More so, marginal effect of natural resources is reported.

3. Resuls and Discussions

According to theory, a dynamic model's lagged dependent variable should be positive and significant. Lagged growth dependent revealed a positive coefficient. This supports model dynamic specification as shown in Table 1 with values of 0.975 and 0.995, 0.6796, 0.977, 0.761, and 0.9813 for models 1, 2, 3,4, 5 and 6 respectively. Regressing all 54 countries, We found that both capital flow and natural resources reduce economic growth in Africa. The results of this study support theories like the Lucas paradox and the widely held assertion [29, 30], that capital flows have a detrimental influence on economic growth in underdeveloped nations, with a coefficient of -0.0580, -0.0400, -0.0150, -0.0577, -0.0119, which are all significant at 1% (see Table 2). However, model 6 shows that capital flow has a positive and significant impact on economic growth as supported by [29, 31-34]. While when the capital flow interacts with natural, it shows a positive coefficient at 1% levels. Suggests an increase of 0.004188 and 0.0009 in economic growth as a result of a 1% change in the natural resources extraction.

In the case of natural resources, it lowers GDP and export income, therefore resources alone are adverse to African economic growth. Logically, the finding recommends that a 1% increase in natural resources explorations results in a 0.1690, 0.1249, 0.0593, 0.1650, 0.0525, and 0.0087 per cent decrease in growth as shown in models 1, 2, 3, and 4 respectively (see Table 4). Investing-wise, in the same Table 4, domestic investment affected African economic growth positively and negatively.This shows a mixed finding based on model estimates. All models show that human capital boosts Africa's economic growth.

On the other hand, population has a negative impact on Africa's economic growth rate (see Table 2). Diagnostics test indicated system GMM results are reliable. The Sargan test of over-identifying restrictions showed that the models' analysis tools are valid because their probability values exceed the 5% significant level. Autocorrelation is absent because the second-order test failed to accept the null hypothesis even though the first-order test indicated autocorrelation.Thus, estimated findings are robust.

The results for the correlation, as reported in Table 1 reveal that natural resources, interaction term, and human capital decrease economic growth due to negative correlation, findings indicating a negative coefficient. On the other hand, capital flow investment ,and population increase growth, this is theoretically reasonable because the capital flow and population affect growth positively. The correlation matrix reveals no multicollinearity in the variables used, shown in Table 1.

Table 1: Correlation Matrix

VARIABLE	RGDPC	CAPFL	NATRR	CAPFL_NATRR	INVET	HUCAP	POPGR
RGDPC	1						
CAPFL	0.0887	1					
NATRR	-0.1094	0.0395	1				
CAPFL_NATRR	-0.1116	-0.0752	0.0916	1			
INVET	0.2008	0.0631	-0.1582	0.0314	1		
HUCAP	-0.0713	0.4241	-0.0019	0.0653	-0.1345	1	
POPGR	0.3165	0.0569	0.0192	0.0167	0.0940	-0.1258	1

Notes: RGDPC= Real gross domestic product per capita, CAPFL = Capital flow, INVET= Investment, HUCAP=Human Capital, POPTR= Population growth rate, Sq. Dev.= Square deviation, Std. Dev. = Standard Deviation.

Source. Author’s Computation

Table 2. One-Step and Two-Step System GMM, Dependent variable: RGDPC

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L.RGDPC	0.9750***	0.9950***	0.6796***	0.9770***	0.7610***	0.9813***
	(0.0103)	(0.0028)	(0.0241)	(0.00675)	(0.0161)	(0.0015)
CAPFL	-0.0580***	-0.0400***	-0.0150***	-0.0577***	-0.0119***	0.0034***
	(0.0173)	(0.0054)	(0.0021)	(0.00695)	(0.00121)	(0.0012)
NATRR	-0.1690***	-0.1249***	-0.0593***	-0.1650***	-0.0525***	-0.0087***
	(0.0486)	(0.0142)	(0.0145)	(0.0202)	(0.00982)	(0.0014)
CAPFL*NATRR	0.0267***	0.0175***	0.0049***	0.0263***	-	-
	(0.00717)	(0.0024)	(0.0007)	(0.00313)		
INVET	0.0153**	0.0196***	-0.0537**	0.0124***	-0.0120	0.0186***
	(0.0073)	(0.0031)	(0.0268)	(0.0040)	(0.0239)	(0.0029)
HUCAP	0.0322***	0.0402***	0.0218***	0.0317***	0.0287***	0.0188***
	(0.0078)	(0.0033)	(0.0034)	(0.0026)	(0.0025)	(0.0018)
POPTR	-0.00172	-0.0019**	-0.0120***	-0.00186***	-0.00981***	-0.0028**
	(0.0028)	(0.0008)	(0.0028)	(0.0006)	(0.0021)	(0.0013)
CONSTANT	0.5720***	0.2961***	2.5799***	0.5170***	1.9185***	0.2377***
	(0.1860)	(0.0490)	(0.2276)	(0.0803)	(0.1344)	(0.0187)
Sargan test of over identifying restrictions	327.9090	42.1502	40.6327	41.9424	43.4342	50.21456
	(0.0000)	(0.8335)	(0.2013)	(1.0000)	(1.0000)	(1.0000)
Arellano-Bond tests for AR (2)	-	-1.9434	-1.5114	-1.9312	-1.7016	0.8895
		(0.0520)	(0.1307)	(0.0535	(0.0888)	(0.3737)
Observation			772	838	772	959
Threshold	2.17(8.76%)	0.71(2.04%)	3.0612(21.35%)	2.19 (8.94%)	2.35(10.45%)	9.67(15787.91 %)
Marginal Effect:						
Mean	19.9379	9.3034	3.6546	19.9379	3.1207	0.6653
Min.	-404.6989	-189.4966	-74.3144	-398.6377	-63.3581	-13.6482
Max.	425.6666	199.2241	78.1036	419.2319	425.6090	14.3396
Regression	One-Step	Twp-Step	Two-Step	Two-Step	Two-Step	Two-Step

Notes: RGDPC= Real gross domestic product per capita, CAPFL = Capital flow, INVET= Investment, HUCAP=Human Capital, POPTR= Population growth rate *a. Robust Estimation Test*

Table 3. First Generation Panel Data Unit Root Test

	Levin, Lin, and Chu				Im, Pesaran, and Shin W-stat			
	Level		First Difference		Level		First Difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	Intercept	Intercept & Trend	Intercept	Intercept & Trend
RGDPC	-37.92*** (0.000)	-37.89*** (0.000)	-31.69*** (0.000)	-28.56*** (0.000)	-2.683*** (0.004)	-8.772*** (0.000)	-11.44*** (0.000)	-13.12*** (0.000)
CAPFL	-1.871** (0.030)	-1.504* (0.066)	-5.216*** (0.000)	-2.997*** (0.001)	-0.3853 (0.350)	-1.7357** (0.041)	-7.868*** (0.000)	-8.407*** (0.000)
NATRR	-50.30*** (0.000)	-57.36*** (0.000)	-45.01*** (0.000)	-50.99*** (0.000)	-12.76*** (0.000)	-14.97*** (0.000)	-17.06*** (0.000)	-17.98*** (0.000)
INVET	-22.11*** (0.000)	-17.74*** (0.000)	-13.53*** (0.000)	-25.24*** (0.000)	-5.866*** (0.000)	-18.97*** (0.000)	-11.86*** (0.000)	-23.55*** (0.000)
HUCAP	-0.641 (0.261)	-2.236*** (0.012)	-7.186*** (0.000)	-7.970*** (0.000)	1.182 (0.881)	-0.175 (0.430)	-6.876*** (0.000)	-5.874*** (0.000)

Notes: RGDPC= Real gross domestic product per capita, CAPFL = Capital flow, INVET = Investment, HUCAP= Human Capital while *, **, *** denote significance levels at 10%, 5%, and 1%, respectively.

Source. Author's Computation

To address cross-sectional dependence in residuals, severity in dynamic panel data analysis, spurious results, and other issues, the first unit root tests were run [35-39]. Based on our findings, the variables are stationary at both level and first difference (see Table 3)

Table 4. Second Generation Unit Root Tests

Variable	Level	First Difference
RGDPC	-1.960***	-3.085
CAPFL	-2.753***	-3.620***
NATRR	-2.833***	-4.386
INVET	-1.722***	-1.409***
HUCAP	-2.110***	-3.523***

Notes: RGDPC= Real gross domestic product per capita, CAPFL = Capital flow, INVET = Investment, HUCAP= Human Capital while *, **, *** denote significance levels at 10%, 5%, and 1%, respectively.

Furthermore, we used the second-generation unit root test by Pesaran [36] this has a robust test for CD and reveals that economic variables are significant at the 1% level [36, 40] (see Table 4). This paper also used a CD test to avoid invalid hypothesis rejection or acceptance (see Table 5). In addition, a theory was created and tested to establish cross-sectional dependence, viz:

H_0: There is no cross-sectional dependence.

H_1: There is cross-sectional dependence among units.

In three tests for cross-sectional dependence in Table 5 reveals that all cross-sectional dependence tests are significant at 1%. It's evident why African countries' capital flows and growth depend on natural resources.

Table 5. Cross-sectional dependence (CD) Tests Results

	Breusch -Pagan LM	PV	Pesaran scaled LM	PV	Pesaran CD	PV
RGDP	943.7403	0.0000***	38.66606	0.0000***	6.775994	0.0000***
CAPFL	492.3002	0.0000***	15.50767	0.0000***	0.378338	0.0000***
NATRR	3198.261	0.0000***	154.3205	0.00000***	56.55054	0.0000***
INVET	837.5995	0.0000***	33.22115	0.0000***	3.552640	0.0000***

Notes: RGDPC= Real gross domestic product per capita, CAPFL = Capital flow, INVET = Investment, and *, **, *** denote significance levels at 10%, 5%, and 1%, respectively. PV= Probability Value, CD= Cross-sectional dependence, LM= Logarithms Multiplier, while *, **, *** denote significance levels at 10%, 5%, and 1%, respectively.

Table 6. Westerlund ECM Panel Data Co-Integration Tests

Ho: no co-integration	Value	P-Value
Gt	-3.093	0.000***
Ga	-12.101	0.019***
Pt	-11.956	0.002***
Pa	-8.142	0.094*

Notes: Gt & Ga = group mean test; Pt & Pa =panel mean test while *, **, *** denote significance levels at 10%, 5%, and 1%, respectively.

Cointegration affects the long-term connection between two variables. We uses a new co-integration method by [41, 42] to ascertain the long-run nexus between variables.The Westerlund tests as shown in Table 6, proved long-run co-integration between economic growth ($RGDPC$), capital flows ($CAPFL$), natural resources ($NATRR$), investment ($INVET$), and human capital ($HUCAP$). The estimation shows that the probability for group and panel mean tests (Gt, Ga, Pt, and Pa) is below 10%. So, the study rejects the null hypothesis of no co-integration. More so, according to Persyn and Westerlund [41], Westerlund tests findings are more elastic to lag and lead lengths (see Table 6)

4. Conclusion and Policy Implication

The study aims to evaluate how natural resources affect capital flow to Africa. The paper shows that resources indirectly affect growth via capital flow. Based on our study questions, capital flows do not cause economic growth in Africa. To answer the second question, natural resources do affect capital flows to African economies. And as capital flows and resources interact, economic growth increases (see Table 2). Also, human capital increases growth rate. Thus , capital flows and natural resources do not contribute to Africa's growth, either through income generating or job creation and this has policy implications. This suggest that Policymakers should focus on human capital development to boost economic growth. This means, the study's findings will help policymakers improve human capital and domestic investment in growth-impacting sectors of the economy.

This study's contribution to the literature is not restricted to; The study is the first to examine Africa's natural resources, capital flows, and economic growth holistically and to include their interaction. Also, this study uses system GMM approaches for a more robust dynamic panel econometric approach, first- and second-generation unit root test, cross-sectional dependency tests and Westerlund cointegration tests solemnly that has merits over other estimator which tackle country time and specific effects, linearity and simultaneity problem associated with ARDL, OLS and cross-section evaluator. This means a model linking natural resources, human capital, and capital flows can be developed.

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