Testing the Resource Curse Hypothesis in Central Africa

Achille Dargaud Fofack

***Abstract*—The aim of this paper is to test the resource curse hypothesis in the resource-rich Economic Community of Central African States. Using a panel of 11 countries from 2003 to 2020, correlation, cointegration, causality test and regression analyses are carried out. Both the economic and the political resource curse hypotheses are tested with a broad definition of total natural resources wealth including fuel and non-fuel resources. Resource dependence and resource abundance indicators are used for robustness check. The analyses reveal that: (i) there is little evidence supporting the political resource curse hypothesis in Central Africa. (ii) the economic resource curse operates via the alteration of dimensions of welfare such as health and education, that transcend income per capita. (iii) an increase in natural resources endowment adversely and significantly affect economic development in the short run. (iv) in the long run, natural resources endowment significantly contributes to development in the region.**

***Index Terms*—Natural resources, resource curse, institutions, central Africa.**

I. Introduction

It is generally assumed that natural resources are blessings and resource-rich countries are fortunate because their natural capital can be converted into schools, roads, homes, hospitals, education programs, public health policies, welfare schemes, and other forms of capital that ultimately foster economic development [1]. Historically, this has been the case of countries such as Norway, Botswana, Australia, Canada, and the United States among others [2], [3]. However, empirical evidence often suggests and [4] argues that ''Rich parents sometimes spoil their kids. Mother Nature is no exception.'' Thus, natural resources endowment is also associated with multidimensional turmoil in resource-rich countries, giving rise to the concept of resource curse.

This concept refers to the quasi-systematic and paradoxical tendency for natural resources to induce market and institutional failures that ultimately disrupt economic development [5]. Countries such as Angola, Venezuela, Sudan, Gabon, Nigeria, the Democratic Republic of Congo, or Djibouti are often cited to illustrate this concept [3], [6].

The curse has both an economic and a political dimension. The economic dimension refers to the negative relationship between natural resources wealth and economic performance induced by volatile commodity markets, declining terms of trade, the enclave nature of extractive industries, higher inflation, exchange rate appreciation, higher income inequalities, and slower diversification of the economy [1], [7]. It is often argued that the political dimension of the resource curse is primordial because the economic decisions of any state are essentially products of its institutional framework [8]. Thus, the political resource curse refers to the negative effects of natural resources wealth on a country's overall governance [9]. Indeed, it is found that resource-rich countries are more prone to conflict, corruption, authoritarian regimes, inefficiencies in public expenditure, healthcare, and education [10].

However, there is substantial evidence showing that despite the abundant literature on the topic, the resource curse could just be a ''myth'' or ''a statistical mirage'' [11], [12]. It is argued that the negative correlation between natural resource wealth and economic performance does not necessary imply that the former causes the latter [13]. Moreover, resource dependence and resource abundance indicators often lead to contradictory results. Finally, empirical studies often use a narrow definition of natural resources excluding non-fuel minerals and forest wealth. They also focus on economic growth and neglect other dimensions of development.

Debates on the existence or not of the resource curse have inspired this paper of which the aim is to test the resource curse hypothesis in the resource-rich Economic Community of Central African States (ECCAS). This is a regional organization created in 1983 to foster economic development and establish a common market between Angola, Burundi, Cameroon, Chad, Central African Republic, Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe. As revealed by [14] and [15], this region covering about 22% of the total area of Africa (6,641,000 km2), accounts for a third of its oil production and half of its copper mine production. The ECCAS also accounts for 25% of global cobalt production, more than 50% of global industrial diamond and tantalum production, and a substantial share of other minerals such as platinum, iron ore, gold, or niobium. Furthermore, the region has a great amount of tropical wood as it is covered by the second largest rainforest (2 million km2) in the world after the Amazon Basin.

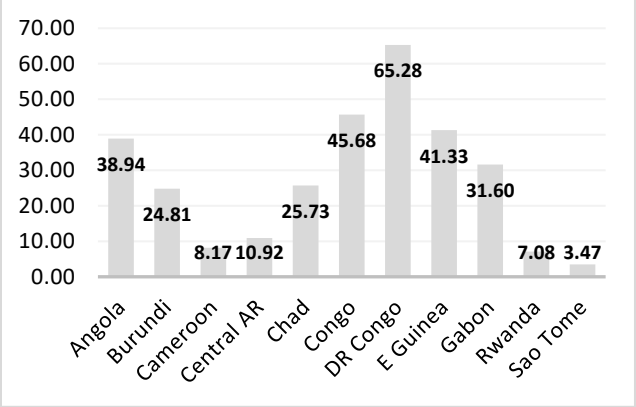

Fig. 1. Average total natural resources rents (% GDP) received by Central African countries between 2002 and 2020.

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Central African countries are highly dependent on natural resources. In 2013, petroleum and natural gas accounted for 97% of exports, 80% of government revenue, and 42% of GDP in Angola meanwhile they represented 92% of exports, 86% of government revenue, and 70% of GDP in Equatorial Guinea [15]. Fig. 1 shows the average total natural resources rents (expressed in percentage of GDP) received by ECCAS countries between 2002 and 2020. It appears that in 7 of those 11 countries, average natural resources rents accounts for at least a quarter of the GDP. The average dependence ratio even exceeds 65% of GDP in the DR Congo.

ECCAS countries are also characterized by poor economic performance as their growth rate and human development index (HDI) are usually below the African average. [14] even reveals that in terms of economic performance, Central Africa occupies the last position among the five African regions. Fig. 2 represents the average HDI in Central African countries between 2002 and 2020. It shows that in most of those countries, the average HDI is below that of sub-Saharan Africa (0.50), all developing countries (0.63), East Asia and Pacific (0.68), and Latin America and the Caribbean (0.73).

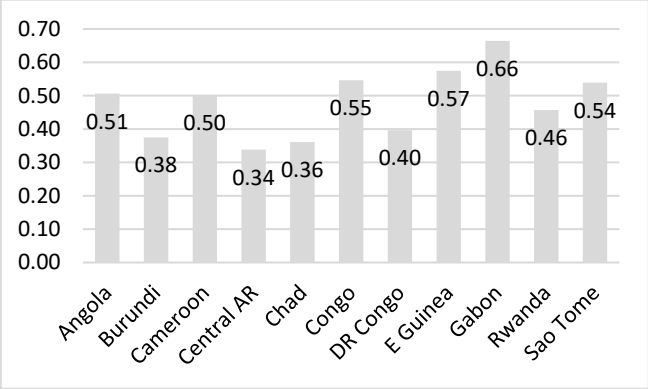

Fig. 2. Average HDI of Central African countries between 2002 and 2020.

Central African countries are finally known for their weak political institutions as the region has witnessed a substantial fraction of all Africa's coup d'état and conflicts and it is home to many of the world's longest-serving presidents. The heads of state of Cameroon, Chad, Congo, and Equatorial Guinea, to cite but a few, have been ruling their respective countries for more than 30 years. Moreover, the megalomania of dictators like Mobutu in the DR Congo or Bokassa in the Central African Republic have also contributed to tarnish the image of political institutions in the region.

In fine, the combination of abundant of natural resources, poor economic performance, and weak political institutions characterizing ECCAS countries creates suspicion related to the curse of natural resources. This paper thus aims to test the resource curse hypothesis in the region. The paper contributes to the literature is many ways: Firstly, a formal causality test is carried out to address the abovementioned concerns raised by [13]. Secondly, resource dependence and resource abundance indicators are used for robustness checks. Furthermore, a broad definition of total natural resources wealth –including fuel and non-fuel resources– is used. Thirdly, the paper takes into consideration a broader indicator of development (the HDI). Fourthly, both the economic and the political resource curse hypotheses are tested.

The remainder of the paper is organized as follows: The next section presents the methodology; the main findings are presented and discussed in Section III; and Section IV concludes the paper with some policy recommendations.

II. Materials and Methods

TABLE I: Description of Variables

Variable	Definition	Source
HDI	Composite index taking into consideration the health, education, and standard of living of the population.	World Bank
GDP	Log of GDP per capita (in U.S. dollar)	World Bank
Resource_Rents	Total natural resources rents expressed in percentage of GDP	World Bank
Resource_Wealth	Log of natural resources wealth per capita	Own calculation
NRR^2	Total natural resources rents squared	Own calculation
NRW^2	Log of natural resources wealth per capita squared	Own calculation
Political	Perception of the likelihood of conflict and terrorism.	World Bank
Corruption	Perception of the extent to which public prerogatives are used for private interests.	World Bank
Military	Government military expenditure expressed in percentage of GDP.	World Bank
Institutions	Composite index representing the simple average of 6 variables: voice and accountability, rule of law, control of corruption, political stability, regulatory quality, and government effectiveness.	Own calculation from Worldwide Governance Indicators

Data related to the 11 members of the ECCAS were collected from the World Bank's World Development Indicators and Worldwide Governance Indicators. The dataset presented in Table I contains the growth rates of each variable over the period from 2003 to 2020. The Human Development Index (HDI) accounts for the standard of living. As recommended by [4], this variable is preferred to the GDP per capita because it measures dimensions of welfare –such as health and education– that are beyond income.

Total natural resources rents account for resource dependence while the square of total natural resources rents is used to assess the long-run impact of natural resource wealth on living standards and governance. In line with [3], a resource abundance indicator –resource wealth per capita– was created by dividing the total income generated from natural resources by a country's population. [3] argues that such a variable can be used to test a ''stark version'' of the resource curse.

To test the resource curse hypothesis in Central Africa, this paper initially relies on the panel causality test developed by [16]. This causality test allows us to take into consideration the heterogeneity of the causal relation as well as that of the regression model proposed by [17]. Paying attention to the trade-off between size and power characterizing this causality test, the lag length is selected to minimize the average Akaike information criterion.

Secondly, panel data regression is used to test the economic resource curse hypothesis in Central Africa. The

baseline model used is given by the following equations:

$$HDI_{it} = \alpha_1 + \alpha_2 Resource\_Rents_{it} + \alpha_3 NRR_{it}^2 + \delta_i + \omega_t + \epsilon_{it}(1)$$

where δ represents country fixed effects, ω stands for time trend, ϵ is the residual, and α_n (n=1,2,3) are the coefficients to be estimated.

The model was initially estimated using the least squares dummy variable (LSDV) method with a panel-specific AR(1) term added to the model to address serial correlation. However, it is well known that economic phenomena are dynamic in nature and that the coefficients of LSDV method are inconsistent for dynamic models. Consequently, the bias-corrected least squares dummy variable (BC-LSDV) method was used to estimate a dynamic version of the model as well as to check the robustness. The bias is corrected using Anderson and Hsiao consistent estimator because it helps address issues related to endogeneity. Finally, the accuracy of the approximation is set to $O(\frac{1}{NT^2})$ and bootstrapped standard errors are computed with 50 replicates.

III. Results and Discussions

The correlation analysis (Table II) reveals that no matter the proxy used, natural resources endowment is negatively associated with both development and governance. It therefore appears that in ECCAS countries, an increase in resource endowment leads to a deterioration in terms of economic development and overall governance, even though that deterioration is not significant. The negative correlation between resource endowment and both economic and institutional performance is in line with the resource curse hypothesis [5], [18].

TABLE II: Correlation Matrix

	HDI	Institutions	Resource_Rents	Resource_Wealth
HDI	1			
Institutions	-0.029	1		
Resource_Rents	-0.056	-0.064	1	
Resource_Wealth	-0.046	-0.113	0.947*	1

* denotes significance at the 5 percent level.

Table III presenting the output of the Im, Pesaran and Shin unit root test shows that all the variables are stationary at level, further analysis can therefore be carried out. The cointegration analysis (Table IV) reveals that there is a long-run relationship between natural resources and economic development on the one hand, and natural resources and political institutions on the other hand. However, the cointegration test does not tell us if an increase in resource endowment is associated with an improvement or a deterioration in terms of development and governance.

TABLE III: Panel Cointegration Tests

	Im, Pesaran and Shin	
	Intercept	**Trend & Intercept**
HDI	-6.124*	-4.447*
GDP	-2.547*	-2.801*
Resource_Rents	-4.585*	-2.940*
Resource_Wealth	-4.541*	-3.310*
NRR^2	-11.544*	-7.644*
RW^2	-4.541*	-3.310*
Corruption	-3.468*	-1.777*
Military	-4.896*	-4.563*
Institutions	-2.324*	-1.779*
Political_Stab	-3.461*	-2.469*

* denotes significance at the 5 percent level.

TABLE IV: Panel Cointegration Tests

Null hypothesis	No cointegration	
ADF	t-stat	prob
Economic resource curse		
Resource_Rents and HDI	-3.650*	0.001
Resource_Wealth and HDI	-3.870*	0.001
Political Resource curse		
Resource_Rents and Institutions	-4.991*	0.001
Resource_Wealth and Institutions	-6.095*	0.001

* denotes significance at the 5 percent level.

The causality analysis (Table V) confirms the doubts expressed by [13] as it reveals that despite the negative correlation between natural resources endowment and political institutions, an increase in the former does not cause the deterioration of the latter thus rejecting in the case of ECCAS countries, the political resource curse hypothesis. Such a conclusion is in line with [19] who argues that the political resource curse ''is not supported by comparative or historical evidence''. Assessing the economic dimension of the curse, the causality test reveals that an increase in resource endowment does cause a deterioration in terms of economic development but does not cause a deterioration in terms of economic growth. It can therefore be concluded after [4] and [11] that the resource curse operates by altering dimensions of welfare such as health and education, that transcend income per capita.

TABLE V: Panel Causality Test

Null hypothesis	W-stat	Zbar-stat
Economic resource curse		
Resource_Rents does not Granger cause HDI	5.830*	2.106*
Resource_Wealth does not Granger cause HDI	4.201*	2.361*
Resource_Rents does not Granger cause GDP	1.503	0.599
Resource_Wealth does not Granger cause GDP	-0.238	-0.538
Political Resource curse		
Resource_Rents does not Granger cause Institutions	-0.381	-0.798
Resource_Wealth does not Granger cause Institutions	0.099	-0.573

* denotes significance at the 5 percent level.

Equation (1) is estimated with natural resource rents as the main independent variable and the results are reported in Table VI. Those results show that current HDI is positively and significantly associated with lagged HDI. The results also

show that natural resources endowment is negatively and significantly associated with HDI. Moreover, this negative and significant correlation is robust across model specifications and estimation techniques. It is also found that in the long run, natural resources endowment has a positive and significant impact on HDI. This finding is also robust to across specifications and estimation techniques.

TABLE VI: ESTIMATES FOR RESOURCE RENTS

	BC-LSDVC		LSDV	
	M1	**M2**	**M3**	**M4**
HDI_{-1}	0.215 (0.081)***	0.237 (0.077)***		
Resource_Rents	-0.011 (0.004)**	-0.012 (0.004)***	-0.012 (0.004)***	-0.013 (0.004)***
NRR^2	0.001 (0.001)***	0.001 (0.001)***	0.001 (0.001)***	0.001 (0.001)***
Institutions	0.001 (0.001)		0.001 (0.001)**	
Political_Stab		0.001 (0.001)***		0.002 (0.001)***
Corruption		0.001 (0.001)		0.001 (0.001)
Military		-0.008 (0.003)**		-0.007 (0.002)***
Cons.			2.165 (0.425)***	2.174 (0.471)***
Obs.	198	198	198	198
Countries	11	11	11	11
R^2	0.2364	0.3082	0.2188	0.2685

*, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors are in parentheses.

TABLE VII: ESTIMATES FOR RESOURCE WEALTH

	BC-LSDV		LSDV	
	M2	**M4**	**M6**	**M8**
HDI_{-1}	0.137 (0.077)*	0.161 (0.074)**		
Resource_Wealth	-0.022 (0.021)	-0.025 (0.020)	-0.019 (0.021)	-0.025 (0.021)
NRW^2	0.003 (0.001)**	0.003 (0.001)**	0.001 (0.001)	0.001 (0.001)
Institutions	0.001 (0.001)		0.001 (0.001)**	
Political_Stab		0.002 (0.001)**		0.001 (0.001)**
Corruption		0.001 (0.001)		0.001 (0.001)*
Military		-0.008 (0.003)**		-0.008 (0.003)***
Cons.			3.029 (0.342)***	3.089 (0.353)***
Obs.	198	198	198	198
Countries	11	11	11	11
R^2	0.2917	0.3497	0.3239	0.3599

*, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors are in parentheses.

Furthermore, it is found that institutions have a positive impact on HDI, even though the significance of that impact is not robust. It is also found that political stability has a positive, significant, and robust effect on HDI while the impact of corruption is positive and insignificant. Finally, the results reveal that military expenditure has a negative and significant effect on HDI.

Table VII reports the estimates of equation (1) with resource wealth as the main explanatory variable. These results are essentially in line with those reported in Table IV. That is, lagged HDI has a positive and significant impact on current HDI; in the long-run, resource wealth has a positive and significant impact on HDI; institutions and corruption are both positively correlated with HDI; political stability and military expenditure respectively have a positive and significant and a negative and significant impact on HDI. However, Table VII shows that there are some differences between the effects of resource rents and those of resource wealth on HDI. First, the coefficients associated with resource rents tend to be smaller than those associated with resource wealth. Second, those coefficients are negative and significant for the former and negative and insignificant for the latter.

In the case of total natural resources rents, the regression analysis reveals that an increase in resource endowment adversely and significantly affect economic development. This finding supporting the resource curse hypothesis is in line with [20] who found that commodity exports significantly impede human development in Central African countries. Table VI also reveals that in the long run, resource endowment significantly contributes to velopment in the region. This could be explained by the fact that, with time, ECCAS countries are gradually learning to draw the best out of their natural resources. As revealed by [21], Chad for instance, passed in 1999, a law on the management of its oil revenues. The country also passed two enforcement decrees in 2003 and 2004. Under that law, 10% of oil royalties and dividends are saved for future generations while the rest is essentially spent on health, education, infrastructures, rural development, environment, and water resources. Decisions like this tend to create linkages between extractive industries and the rest of the economy and foster long-term welfare.

The regression analysis also reveals that both political stability and military expenditure significantly affect development in ECCAS countries. This is in line with the resource curse literature since resource-rich countries are often afflicted with violent conflicts induced by rent-seeking geopolitical, ethnic, or religious.

In the case of natural resources wealth per capita, the regression analysis also reveals that an increase in resource endowment adversely affect economic development but this time around, the effect is found to be insignificant. The difference between the results found above with a resource dependence indicator and those found with resource wealth could be explained by the bias inherent to this resource abundance indicator. Indeed, [3] who inspired this proxy argues that the variable is ‘‘biased upward [against finding a resource curse] in countries that are more democratic, peaceful and stable’’. Although overall governance is still poor in ECCAS countries, the situation is improving in many respects: peace is back, the political environment is stable, and there are small democratic improvements in many countries. Apart from the significant effect of natural resources on development, the results found with resource wealth are in line those found with resource rents.

TABLE VIII: ESTIMATES FOR POLITICAL RESOURCE CURSE

BC - LSDV		
	Resource_Rents	Resource_Wealth
$Institutions_{-1}$	0.052 (0.077)	0.056 (0.078)
Resource	-0.336 (0.451)	-2.401 (2.087)
$Resource^2$	0.001 (0.004)	-0.138 (0.151)
HDI	3.560 (8.218)	5.449 (8.252)
Obs.	198	198
Countries	11	11
R^2	0.0659	0.0761

Finally, the political resource curse hypothesis is tested while controlling for economic development. It is found that an increase in either resource rents or resource wealth leads to a deterioration of a country's institutions, even though that deterioration is not significant. Such a negative correlation between natural resources and political institutions is not surprising because, as argued by [22], public authorities in resource-rich countries often adopt seemingly aberrant policies –in the sense that they go against public interests– that are in fact ''rational political strategies in response to the incentives induced by resource rents''.

IV. CONCLUSION AND RECOMMENDATIONS

In sum, the cointegration, correlation, causality, and regression analyses reveal that: (i) there is little evidence supporting the political resource curse hypothesis in Central Africa. (ii) the economic resource curse operates via the alteration of dimensions of welfare such as health and education, that transcend income per capita. (iii) an increase in natural resources endowment adversely and significantly affect economic development in the short run. (iv) in the long run, natural resources endowment significantly contributes to development in the region.

Those findings call for increased transparency in the collection, management, and spending of natural resources wealth in Central Africa. Indeed, as emphasized by [3], [19] and [23], transparency is the most important virtue inherent to any policy designed to fight the resource curse. In that vein, ECCAS countries should welcome initiatives such as the Kimberley Process Certificate Scheme (KPCS) and the Extractive Industries Transparency Initiative (EITI) that foster transparency in the exploitation of natural resources. Angola, Burundi, Central African Republic, Congo, Equatorial Guinea, Gabon, and Rwanda are therefore invited to join the KPCS while Burundi, Chad, Equatorial Guinea, Rwanda, and Sao Tome and Principe are invited to join the EITI.

In line with the successful Norwegian experience, it is recommended that natural resources wealth in Central African countries be managed by sovereign wealth funds (SWFs). These sovereign wealth funds are often preferred to governments because they are independent institutions insulated from political influence. Moreover, they examine the trade-off between the wellbeing of present and future generations, smooth out the pattern of public expenditures, and help avoid the Dutch disease [23], [24]. Angola, Gabon, Equatorial Guinea, and Sao Tome and Principe have already established SWFs that oversee their respective oil wealth. Once again, transparency should be the guiding principle here. The Fundo Soberano de Angola for instance, has taken some bold steps in that direction: the fund is member of the Sovereign Wealth Fund Institute which rates the transparency of its members; it has ratified the Santiago principles on best management practices in SWFs; it is accountable before the Angolan parliament; and it is audited by Deloitte, an independent external entity. Other ECCAS countries should follow the lead of the Fundo Soberano de Angola, even though there is still room for improvement in its management.

Central African countries can also alter the enclave nature of extractive industries, create socioeconomic linkages, and appease ethnic tensions in mining communities by creating mining area community development funds (MACDFs) like those created in post-war Sierra Leone. [25] argues that such funds collecting a fraction (25% of diamond export taxes in Sierra Leone) of natural resources wealth and investing it in local development projects (such as education, healthcare, access to clean water, etc.) can help avoid the curse of natural resources. Moreover, the socioeconomic backward, forward, horizontal, spatial, and fiscal linkages created by such development funds not only promote social cohesion but also foster economic diversification (UNCTAD, 2017).

ECCAS governments should also strive to ''receive the most that they can for their natural resources'' [24]. They should follow the Norwegian example and foster significant local participation in extractive industries. Such an approach will help local companies build up expertise and enjoy the high profits inherent to those industries. They should also have passive ownership shares in extractive industries like Norway does via the State's Direct Financial Interest [24]. In line with this recommendation, [23] argues that the IMF and other multilateral institutions should not ''put undue pressure'' on Central African countries to privatize their natural resources industries.

Another way to receive the most from natural resources is through high taxes. Indeed, the Norwegian government collects a 78% profit tax (28% normal profit tax plus 50% petroleum tax) from the hydrocarbon industry [24] while the average effective tax rate on petroleum is less than 40% in countries such as Cameroon and DR Congo [26]. It is therefore recommended that Central African countries increase the taxation of extractive industries. In that respect, the new Gabonese hydrocarbon code passed on July 16, 2019 is highly criticized because it cuts the profit tax on petroleum from 35% to 0%. Moreover, it brings down the proportional mining royalty, leading to an increase in cost oil and a fall in profit oil. This new hydrocarbon code also limits public participation in petroleum projects to ''only'' 10% (versus 20% previously). In fine, such a law seems to favor multinational corporations and foreign investors at the expense of the Gabonese people.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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