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## Article

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## Exploitation of Mineral Resources and Economic Growth in CEMAC: The Role of Institutions

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### ABSTRACT

#### **Purpose:**

The objective of our study is to determine on one hand the effect of the exploitation of mineral resources on economic growth of CEMAC member countries, and on the other hand to examine the role of institutions in the transmission of these effects.

#### **Design/methodology/approach:**

To achieve our goals, we formulated an econometric model in panel data concerning countries of this economic community. Using the fixed effects method and two stage least squared method over the period 2002 to 2016, a period during which we observed not only a surge in the prices of natural resources in the markets but also a fall in the prices of basic resources following two large exogenous shocks. First, the “subprime” crisis and the 2015 oil crisis.

#### **Finding:**

From our findings, mineral rent has a positive and significant effects on economic growth. Subsequently, when we control our model with all the variables capturing institutions of governance (Voice and responsibility, Political stability and absence of violence / terrorism, Government Effectiveness - Regulatory quality, Rule of law, and Control of corruption), the results of our regressions were robust. In effect, good governance ensures the proper distribution of mineral rent throughout the economy and contributes to economic development. We came to the conclusion that these institutions of governance do not play a role in the transmission of the positive effects of mineral rent on economic growth.

#### **Research limitations/implications:**

The following where limitations encountered in our study. Firstly, the temporal dimension of our study (15 years). Secondly, the failure to take into account certain institutional variables such as democracy or the type of political regime.

#### **Originality/value:**

Our study enriches the literature of natural resource curse; it is in line with those who have shown that abundance in basic commodities or natural resource is not necessarily a hindrance to economic development.

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### 1. Introduction

The exploitation of natural resources has favored economic development of countries such as Great Britain and Northern Ireland during the first Industrial Revolution in the 18th and 19th centuries. Natural resources also played an important role during the early stages of development in countries such as the United States of America, Canada and the Netherlands. Jevons (1865) predicted the depletion of natural resources during the industrial revolution following excessive exploitation.

The first study on natural resources focused on the characteristics and rate of extraction of natural resources (Hoteling, 1931). At that time, the prevailing idea was to define an optimal rate of exploitation or extraction of these resources since some of them had renewable characteristics.

After the first petroleum shock in 1973, studies gradually moved away from those of the 1930s. In the 70s, the depletion of natural resources and an inter-generational allocation of resources caught the attention of researchers.

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Hartwick (1977) evoke the idea of substituting different forms of capital which according to him, it is possible that a natural resource that has run out completely can be replaced by artificial capital.

In addition, the second petroleum shock of 1986 really opened up the debate on the relationship between natural resources and economic development. It was then that the concept of "natural resource curse" was introduced in economic literature by Auty (1993).

After the 1970s and 1980s shocks, which significantly affected the global economy in the years 2008 and 2010, economies were hit again by two major crises. The first being the financial crisis of 2008 caused by the poor financial policies of the United States of America and which quickly affected the global economy. CEMAC countries suffered particularly due to the fact that the 2008 financial and economic crisis affected the main drivers of growth in Africa in general. There was a fall in the demand and prices for African raw materials and promises to increase official development assistance made by developed countries could not be fulfilled (ADB, 2009).

The second crisis occurred in 2016 where the price of crude oil after having fluctuated for several years between 80 and 110 US dollars began to fall in the second half of 2014. A slight increase was observed in spring 2015, passing thus to 60 US dollars per barrel, a rise due to seasonal increase in American demand ("driving season" from April to September), during which Americans use their vehicles massively for trips. Prices fell further at the end of summer where WTI (West Texas Intermediate) fell below 40 US dollars per barrel in late August 2015 and stood at 45 US dollars per barrel on September 9, 2015 (DGRIS, 2015).

These crises unveiled the vulnerability of CEMAC countries to exogenous shocks. The economic vulnerability of countries of this community can be observed through the fall in GDP during and after the crisis.

**Table 1: Evolution of the growth rate of GDP before, during and after the crisis in the CEMAC countries**

Countries	CMR	CHAD	CONGO	RCA	GABON	EQUATORIAL GUINEA
Growth in GDP 2014	5.88	6.89	6.77	1.04	4.31	0.41
Growth in GDP 2015	5.65	1.79	2.69	4.79	3.87	-9.08
Growth in GDP 2016	4.45	-7	-1.86	4.53	2.26	-8.93

Source: Built by authors based on WDI (2017)

In 2014 before the crisis, GDP growth in Equatorial Guinea stood at 0.41. In 2015, a drop of dropped to - 9.08; because its economy is mainly supported by the exploitation of petroleum resources. Likewise, Chad and Congo observed a drop in their growth from 2014 to 2016, going from 6.89 to -7 and 6.77 to -1.86 respectively. CEMAC countries which suffered less during this crisis were Cameroon, Gabon and CAR.

In fact, despite the decline in growth, Cameroon and Gabon remain positive over the period. In addition, the growth of CAR remains in progression passing from 1.04 in 2014 to 4.53 in 2016; because the latter does not exploit petroleum resources. Likewise, CEMAC states are ranked among the least developed in the world. According to UNDP (2018), the most developed CEMAC country after the crisis in 2015 was Gabon with HDI of 0.702, but the latter is only ranked 110th in the world. Gabon is followed by Congo with HDI of 0.606 and is 137th in the world. Two CEMAC countries namely Chad and CAR are among the top 5 least developed countries on planet with human development indicators of 0.404 and 0.367 respectively. These countries are ranked 186th and 188th in the world ranking.

In addition to the low level of growth and development, CEMAC countries also observed a high level of poverty rate. In fact, 45% of CEMAC population lives on less than 1 US dollar per day. Cameroon, Gabon being the only countries in the sub-region where one-third of the population earns less than a dollar a day. This economic community also has the largest population living below the poverty line of any African sub-region (UNDP, 2018).

On social level, indicators of CEMAC countries are very weak, but have progressed in recent years. In Cameroon, within the early 2000s, schooling rate was 40%. In 2016 it progressed and stood at more than 50%. In Gabon the situation is almost similar to that of Cameroon because in the early 2000s we observed a proportion of around 55% of the total population being educated and in 2016; this proportion was more than 62%. CAR and Chad are considered to be the least educated countries in CEMAC with an education enrollment rate of less than 30% of the total population.

In addition, literacy rate of Central Africans aged 15 to 24 was less than 40% in 2015, about 48% among men and 27.0% among women. This secondary school enrollment rate was only around 13% in 2012. Girls are significantly disadvantaged compared to boys as their secondary school enrollment rate was 17.93% in 2012, close to double that of girls, which stands at 9.34% (UN, 2016). This economic and social excess of countries depending on natural resources is known in the literature as "resource curse" Sachs and Warner (1995, 1997). The natural resource curse highlights the fact that economies depending on natural resources are less developed than those without these resources.

In effect, the work of Sachs and Warner (1995, 1997 and 1999) has shown that the exploitation of natural resources negatively affects economic growth. Their results have been questioned by Lederman and Maloney (2007), Brunnschweiler and Bulte (2008) and Brunnschweiler (2008) Furthermore, natural resources curse was not limited to the negative effects of these resources on growth given that the exploitation of natural resources is inversely linked on one hand, to institutions (Ross; 2001, Brunnschweiler; 2008, Omgba; 2015, Philippot; 2009) and on the other hand to human capital (Gylfason; 2001). Yet institutions and human capital occupy an important place in economic analysis and constitute an explanatory base for several economic failures (Ghamsi et al., 2019).

The exploitation of natural resources can be considered a double-edged sword because, it certainly provides significant financial income, contributes to the fight against unemployment by increasing employment; but it

promotes the establishment of bad institutions, encourages rent-seeking behavior and is the source of grievances, civil wars and rebellions.

The persistence of poor indicators of governance over time in CEMAC countries can be explained by the desire of political leaders, administrators, bureaucrats and parliamentarians to capture part of natural rent. These key actors in decision-making, in the design and implementation of economic policies, are aware of the fact that natural resources provide significant income to states. As a result, they formalize, adopt, implement economic policies and take administrative decisions favorable to their rent-seeking activities. Similarly, when decisions are favorable to the development of all citizens, administrators and bureaucrats who have no particular interest will hinder their application (fake reports, administrative bottlenecks, slowness in the execution of tasks and development projects). Thus, there is collusion between the legislator, politicians and administrators as these groups generally belong to the presidential majority. Bills tabled to the parliament are generally adopted without proper study and as such limiting the role of parliament in overseeing government action. In addition, there is no real separation of powers in these economies as judges and other court workers are recruited and paid by government. This situation prevails because it favors a group of elites who monopolize natural resource rents, to the detriment of the rest of the population. Likewise, several social projects such as the construction of schools, hospitals and roads are neglected as they are lead to the development of a large number of people and require significant financial means.

According to Torvik (2009), countries with good institutions make better use of income from natural resources. The establishment of good institutions is aimed at controlling and coordinating the exploitation of natural resources and to promote the use of income to increase the level of development given that one of the causes of poor economic performance of CEMAC countries in particular is poor governance. Mehlun et al. (2006) show that poor quality institutions are due to the exploitation of natural resources. More specifically, dependency on natural resources favours the establishment of bad institutions.

This study has as first objective to determine the effect of the exploitation of mineral resources on economic growth of CEMAC countries, and secondly, to examine the role that institutions of governance plays in transmitting these effects. The results show that mineral rent has a positive effect on growth per capita. Likewise, institutions have no role in transmitting these effects. The rest of the paper is organized as follow section 2: Literature review, section 3: Methodology, Results and Discussion: section 4: Conclusion.

## **2. Literature Review**

The term "resource curse" was first used by Auty (1993), but it was popularized by the works of Sachs and Warner (1995) as the main theoretical anchor of the Dutch Disease. Sachs and Warner (1995) started from the observation that economies depending on the exploitation of natural resources grow less rapidly than economies without natural resources. Their principal question was that of knowing whether the exploitation of natural resources is disadvantageous for countries rich in it or not. The main limitation of their study was the theoretical explanation of resource curse.

In the same vein, Sachs and Warner (1999) explain why certain countries do not benefit from the exploitation of their resources. They put forward the idea of a big push of natural resources according to which, poor and resource dependent countries need a large demand in order to be able to recover costs. An important question in their studies is whether the increase in prices of natural resources have been beneficial for resource-rich countries. In a study of a group of Latin American countries they show that soaring prices of natural resources is generally accompanied by low growth rate per capita.

The work of Sachs and Warner was followed by Papyrakis and Gerlagh (2004). Unlike Sachs and Warner, they empirically determine the transmission channels of resource curse while examining the direct effects and the abundance of natural resources on growth. Using a growth model, they study the transmission channels through which the abundance of natural resources affects growth. The authors find that the abundance of natural resources has a negative effect on economic growth. However, this negative effect no longer appears when the model is controlled for investment, corruption, openness, terms of trade and education. These variables prove to be the main transmission channels of the curse.

Furthermore, Papyrakis and Gerlagh (2004) measure the indirect impact of the exploitation of natural resources on these transmission channels. Their findings show that investment rate is the most important channel of the curse, accounting for almost 41% of the indirect effect of natural resources on growth. The authors conclude that natural resources can be a lever for economic growth, if the negative effect on these main transmission channels is taken into account.

The works of Sachs and Warner (1995, 1997 and 1999) have been questioned by Hausmann and Rigobon (2003), Shaxson (2005) Van der Ploeg and Ploelhekke (2008, 2010) and Avom and Carmignani (2009). These authors explain the resource curse by the volatility of resources and find that the variable used by Sachs and Warner (the intensity of resources) suffers from endogeneity. In fact, according to Hausmann and Rigodon (2003), countries whose economy is based on the exploitation of natural resources in general and hydrocarbons in particular have a tendency of specializing in the production of non-commercial goods. These countries have a volatile exchange rate, which leads to volatile interest rates, to the point where entrepreneurs can no longer borrow to finance production. This results in a drop in production of the non-tradable goods sector to the extent that the sector is almost non-existent. Similarly, Shaxson (2005) affirms the volatility of commodity prices, more precisely the volatility of oil prices as the cause of the curse. The volatility of the price of this resource can, in fact, distort the forecasts of political leaders, thus leading to social conflicts in non-democratic states where the government has no regard for the citizen

However, volatility leads to poor economic planning, leading to a budget deficit which encourages governments to go into debt. Countries whose economies are based on the exploitation of natural resources tend to go into debt because it offers solvency guarantees on the financial markets (Omgba, 2010).

In another angle, Van der Ploeg and Ploelhekke (2008) highlighted the volatility on the growth of per capita GDP as the cause of the curse. It is said to be a very important and long neglected factor in the natural resource curse of Sachs and Warner (1995, 1999). In their empirical analyzes, they show that countries with high volatility in annual growth in GDP per capita, generally have low economic growth, as the case for sub-Saharan countries, Latin America, and the Caribbean, whose economy depend on basic commodities. As for Avom and Carmignani (2009), they evoke volatility, openness and inequality as potential channels for transmitting the curse. They determine the role of nature ("mother nature") on development. According to them, economic development is not just an effect of income growth even if growth is an important condition for development and poverty reduction. More importantly, they believe that the effect of natural resources on development goes beyond the effect on per capita product. Access to basic infrastructure and to health and education services depends on how services are made available to the public. Natural resources qualified as "mother nature" are the sum of agricultural raw materials, food and drink, hydrocarbons, metals and minerals as a percentage of total merchandise exports. The development measure used is social development composed of variables such as life expectancy, vaccination and education. They come to the conclusion that two channels of transmission of the curse can be highlighted: volatility and income inequality.

However, the economic explanation for the resource curse is not unanimous among researchers, as others have pointed to political failures to explain the curse. Dependence on natural resources deteriorates the political climate in a country since the exploitation of natural resources cause civil wars (Collier and Hoeffler, 2000, 2005).

Collier and Hoeffler (2005) argue that armed conflict and civil war need to be motivated and several causes can be identified. The costs and benefits of war are important determinants of civil war. This hypothesis had been raised by Collier and Hoeffler (2000). However, they recognized that their postulates are not satisfactory enough since the rebel groups, in most cases, had enough to cover the costs of the conflict. In their previous analysis, institutions, political conflicts and the duration of the rebellion were associated. But in this case, they treated these elements separately. According to Collier and Hoeffler (2005), some rebel groups are not concerned with the common good, but with a special interest and are motivated by greed and selfishness. In their analyzes they define a civil war as an internal conflict having caused the death of at least 1000 people where in which 5% of rebel or government forces have left their lives. They conceive this definition so that civil war and rebellion are not confused. Furthermore, Fearon and Laitin (2003) exposed the fact that countries depending on petroleum resources are more exposed to the risk of conflict than countries not depending on other types of natural resources. According to these authors, the exploitation of natural resources would favor clientelism. Here, income from the exploitation of petroleum resources encourages political powers to be interested in the supply of collective goods for the benefit of clientelism practiced for personal ends. However, this practice may be limited by institutions that hold political powers. In general, one can observe that countries plagued by civil wars, rebellion and armed conflicts are those with poor quality institutions.

Mehlum et al., (2006) show that poor quality institutions are the main cause of natural resource curse. They start on the basis that certain countries are "winners" in natural resources (profit or gain their development on the basis of their endowment in natural resources) and that others, "losers" in natural resources (who are losers or who earn nothing from their endowment in natural resources). They refer to countries such as Australia, Norway, and Botswana as "winners" among the countries in the world rich in natural resources. Studies carried out by the World Bank show that 5 out of 82 natural resource -rich are from the top 8 of the richest countries on the planet and from the top 15 of countries with high GDP per capita.

Furthermore, Brunnschweiler (2008) shows the importance of quality institutions for growth and economic development. The regression made in this regard shows a positive and significant relationship between economic growth and institutions (rule of law and government efficiency). Similarly, there is a positive relationship between the abundance of natural resources and institutions (rule of law and efficiency of government), but these results are not robust because, when control with initial income (GDP in 1979) institutions are no longer significant,

In the same vein, Brunnschweiler and Bulte (2008) set three objectives in their study. Firstly, the relationship between dependence on natural resources and quality of institutions; secondly, alternative measures of the abundance of natural resources on growth and quality of institutions and thirdly, how the constitutional variables interact to create a vicious or virtuous cycle of development. Poor quality institutions are one of the major causes of natural resource curse. Brunnschweiler and Bulte (2008) show that by considering only extractive resources, the measures of resource abundance proposed by Sachs and Warner (1995) positively influence the quality of institutions. Also, governance system (parliamentary or presidential) is more efficient than the electoral system. They show that it is easier for extractive companies to put pressure on elections than on the design of economic policies. Institutions become effective when they improve the living conditions of the population. For this, it is necessary that all citizens participate in the designation of their representatives at the local level and through free and transparent elections. However, the exploitation of natural resources may hinder democracy.

According to Omgba (2015), the level of democracy in oil exporting countries tend to be positively correlated with the length of time between the beginning date of oil production and the date when the countries reached political independence. He formalizes a variable called "distance" where  $Distance = T_{production} - T_{independence}$ .  $T_{production}$  represents the date a country began oil production; and  $T_{independence}$  the date the country obtained its independence. He hypothesizes that the greater  $T_{production}$  is compared to  $T_{independence}$ , there is a high probability that this country will be more democratic compared to other oil-producing countries, all other things being equal. Note also that the most important in the analysis of Omgba (2015) is not the distance ( $T_{production} - T_{independence}$ ).

independence), but the institutional dynamics that this distance reveals. Because, it is clear in the analysis that time is necessary for the establishment of a true democracy.

The institutional dynamic in the work of Omgba (2015) concerns the dynamics of institutional policy. Among the formal institutions, we can distinguish economic institutions from political institutions. Economic institutions define the rules for human interaction in the economic field (e.g. property rights) and political institutions define the rules in the political arena, including democracy. In other words, the nature of the resources exploited during the colonial period influenced the nature of the political institution created by the settlers. These institutions were maintained after independence because it benefited the ruling national political elite.

In a more specific setting, Torvik (2009) questions the reasons why some resource-rich countries thrive, while others do not. His study is based on the fact that natural resources have led to the prosperity of certain countries such as Norway and Botswana and the stagnation of other countries such as Nigeria and Venezuela. In other words, some countries are more prosperous (the winners) in the exploitation of natural resources and others less prosperous (the losers). However, Trovik (2009) identifies six dimensions in which the winners and losers can be different:

- saving of income from resources: We can just take the fictitious example of a country which markets non-renewable natural resources and places the product on the financial market. There is a reduction in the natural capital of this country; although there is an increase in financial capital, the wealth of this country is unchanged. If the country decides to consume all the income from the marketing of its resources, it is quite clear that its savings rate will be negative. But then, it will be noted in his national accounts that his savings are equal to zero, which does not reflect reality.

- Presidential versus parliamentary regimes: research shows that political regimes have an effect on the curse of natural resources. Andersen and Aslaksen (2008), show that the curse is more common in presidential system than in parliamentary ones.

- Quality of institutions: countries which have good institutions make better use of the income derived from the marketing of these resources.

- Type of resources: natural resources do not have the same effect on growth. Soil and subsoil resources have different effects on economic growth. For Brunnschweiler (2008), petroleum and mineral resources are of great value on the markets, which is not the case for agricultural resources.

- "Offshore versus onshore oil": countries which exploit sea resources run less risk on the attacks of rebels and armed groups than the countries exploiting the oil resources on the continent.

- The first industrialized countries / the last industrialized countries: at the beginning of the 1900s, Norway which was one of the poorest countries in Europe is today classified among the developed. This remarkable transition is due to the exploitation of natural resources. Norway started with wood, then with mineral resources; then it continued in the hydroelectric sector and at the beginning of the 70s, it launched out in the exploitation of oil and gas resources, unlike some countries like Nigeria or Angola which have a weak experience in the industrial and energy sector and who still find it difficult to convert their natural wealth into economic development.

### 3. Data, Methodology and Empirical Results

Our study focus on CEMAC and this economic community includes six countries; among them, four (Cameroon, Congo, Gabon and Tchad) are exporters of mineral resources in general (oils and petroleum) and only one of these countries exploits exclusively petroleum resources (Equatorial Guinea) and another essentially oils (CAR). However, the variables use is from the World Bank database (WDI, 2017 and WGI, 2017).

#### 3.1 Model Specification

Firstly, to determine the effect of the exploitation of mineral resources on growth and secondly the role of institution of governance in the transmission of these effects on the other hand, we formulate an econometric model inspired from that of Papyrakis and Gerlagh (2004) and Aoum (2008). The model identifies the different transmission channels for natural resource curse:

$$Y_{it} = \alpha_i + \mu \text{Rent}_{it} + \beta \text{Open}_{it} + \sigma \text{Invest}_{it} + \theta \text{Educ}_{it} + \lambda \text{Govt}_{it} + \rho \text{Employers}_{it} + \delta Z_{it} + \theta_{it} \quad (1)$$

Where; "Open" is economic openness; "Invest" stands for investment; "Educ" is education, "Govt", government spending and "Employers" the employment rate. Z is the set of control variables in terms of education, and institutional variables.

Taking into consideration our control variables, the final model will become

$$Y_{it} = \alpha_i + \mu \text{Rent}_{it} + \beta \text{Open}_{it} + \sigma \text{Invest}_{it} + \theta \text{Educ}_{it} + \lambda \text{Govt}_{it} + \rho \text{Employers}_{it} + \delta_1 \text{control\_corrup}_{it} + \delta_2 \text{rule\_of\_law}_{it} + \delta_3 \text{regul\_quality}_{it} + \delta_4 \text{govt\_effec}_{it} + \delta_5 \text{pol\_sta\_viol}_{it} + \delta_6 \text{voice}_{it} + \theta_{it} \quad (2)$$

#### 3.2. Choice and justification of variables

The dependent variables are differentiated from the independent variables.

- **Dependent Variable**

- **Y: Growth of GDP per capita:** GDP is the sum of gross value added by all resident producers in the economy, increased by taxes on products and reduced by subsidies not included in the value of products. It is calculated without deducing the depreciation of assets produced and the depletion and degradation of natural resources. Data is in current US dollars. Generally, developed and emerging countries, with sustained and continuous GDP growth, enjoy good quality institutions contrary to developing countries.

- **Variable of Interest:**

- **Mineral rent (Rent):** Mineral rents correspond to the difference between the value of production of a stock of minerals at the world (oils) or regional (petrol) prices and their total cost of production. The minerals included in the calculation are: petroleum, tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite and phosphate.

- **Macroeconomic Variables: determinants of economic growth**

- **Economic openness (open):** Generally, openness is measured by the ratio of exports and imports to GDP. CEMAC member countries are generally trade intensive due to the commercialization of natural resources which represent the largest proportion of exports and import of manufactured products. In effect, income derived from the exploitation of raw materials is subject to less home consumption against foreign consumption. Moreover, according to the Dutch disease theory, the exploitation of natural resources results in an increase in real exchange rate, and hence, the populations will choose to consume imported products which cost less than domestic products. According to Gregory (1976), there is no effective way to reduce this tendency. But to him, investing the income from natural resource exploitation abroad could prevent the business sector from declining. In this case, the marketing of commodities would not benefit the national economy.

- **Government expenditure (Govt):** represents consumption by the government and administrations. The state budget is generally made up of the investment budget and the consumption budget. Consumption includes consumption of public services. Government consumption is considered to be a determinant of institutions insofar as it promotes the proper functioning of public services.

- **Investment (invest):** it is investment made by the public authorities and the private sector. This variable includes land improvements, factories, machinery and equipment purchases, road construction, railways, schools, offices, hospitals, private residential housing, and commercial and industrial buildings.

These different variables have been used in various research studies like those of Mabali (2016), Phillipot (2009) and Brunnschweiler (2008) as determinants of institutional quality "Employers": represents the proportion of people of working age who are in formal employment.

- **Education enrollment rate (educ):** This measures the proportion of a country's population that is in school or the proportion of the population that has attended primary, secondary or higher level. The exploitation of mineral resources can be an obstacle or a gateway to the development of the education sector in a country in the sense that, part of the income derived from the exploitation of mineral resources can be used for investment in the education sector by building schools and recruiting more teaching staff into the civil service. On the other hand, the exploitation of mineral resources can also be an obstacle to education insofar as the exploitation of these resources leads to wars, rebellions and terrorist attacks, pushing the populations with no choice than to abandon school and seeking refuge in more secure places.

- **Employers:** it represents the proportion of people of working age who are employed. The exploitation of natural resources generates many jobs in both the artisanal and industrial sectors. Through employment, part of the income derived from this activity is redistributed to households.

- **Control variables**

The dependent variables used here are the set of institutional variables of the World Bank which capture the quality of governance. These are:

- **Voice and responsibility (voice):** It reflects perceptions of the extent to which the citizens of a country can participate in the choice of their rulers as well as freedom of expression, association and freedom of the media.

- **Political stability and absence of violence / terrorism (Pol\_sta\_viol):** Political stability and the absence of violence / terrorism, measures perceptions of the probability of political instability and or politically motivated violence, including terrorism.

- **Government Effectiveness (Govt\_effect):** Reflects perceptions of the quality of public services, the quality of the public service and its degree of independence from political pressures, the quality of development and implementation policies and the credibility of the government's commitment to these policies.

- **Regulatory quality (regul\_qua)** Reflects perceptions of the government's ability to formulate and implement sound policies and regulations enabling and encouraging the development of the private sector.

- **Rule of law (rule\_of\_law):** represents the capacity of public authorities to respect laws and court decisions.

- **Control of corruption (Contro\_corup):** reflects perceptions of the extent to which public authority is exercised for private ends, including minor and major forms of corruption, as well as the perception that elites and the private sector have of the state. Institutions are the product of a colonial heritage. Pre-independence territories that had hostile environment favourable for settlers inherited poor quality institutions which continued even after independence (Acemoglu et al., 2001). According to the rent research theory modeled by Torvik (2002) the exploitation of natural resources pushes economic agents to adopt counterproductive behaviour that weakened institutions of governance and rent seekers will take advantage of poor governance to increase their activity.

### 3.3 Strategy on the Estimation of Parameters

To determine the effect of the exploitation of mineral resources on growth, we first regress the macroeconomic variables and the variable of interest on per capita growth. Subsequently to examine the role of institution of governance, we introduce each of the control variables in the described regression, to study any disturbance in the transmission of the effects of mineral rent on per capita growth following the reaction of each of these variables.

In this case, we use panel data with its advantages, notably the increase in the number of observations which allows the procedures for comparing theories with observed facts, in other to guarantee better accuracy, estimators, a better

match between the level of analysis of theoretical models and that of statistical observations and also reduce the risks of multi-collinearity between the explanatory variables due to the introduction of inter-individual differences (Pakes and Griliches, 1984) and lastly the inclusion of unobservable effects.

Furthermore, according to Van der Ploeg and Ploelhekke (2010), the variable used to capture the exploitation of mineral resources (Rent) is endogenous as the resource intensity variable of Sachs and Warner (1995). Consequently, the OLS and Generalized OLS technique generally used will provide biased results. Hence, Two-Stage Least Squares is more appropriate in this context. Note also that Brunnschweiler (2008) finds, on the other hand that this variable does not suffer from endogeneity problems.

The Two-Stage Least Squares, (2SLS) is a method of estimation by instrumental variables, introduced by Robert Leon Basman in 1957 and Henri Theil in 1961. The principle of 2SLS consists in performing a regression by substituting the variable which, potentially suffers from endogeneity, by instrumental variables. It is also possible to control the heteroskedasticity of errors with this method.

The three hypotheses supporting 2SLS are:

- The error term must not be correlated with the instrumental variable.
- The variable supposed to be suffering from endogeneity must be strongly correlated with the instrumental variable, but not correlated with the error term.
- The instrumental variable must be a different variable from that assumed to be endogenous.

The Hansen and Sargan test verify the validity of instruments. Indeed, Sargan / Hansen test makes it possible to test whether the instruments are orthogonal to the error term or not, in other words, if there is correlation between the instruments and the error term, Hansen's test is robust to the presence of heteroskedasticity and autocorrelation of errors. If the probability of the Hansen test is greater than 0.1, we cannot therefore reject the null hypothesis (H0) of validity of the instruments. The model thus obtained is exactly identified (or over-identified) and the chosen instrumental variables are valid. However, before estimating the parameters of our model by these different methods, it is essential to present the variables of the model.

#### 4. Results and Discussions

Table 2 presents the fixed-effects regression technique results.

**Table 2: Regression results using the fixed-effects method**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Y	Y	Y	Y	Y	Y	Y
Rent	0.234*** (0.0799)	0.236*** (0.0810)	0.245*** (0.0819)	0.265*** (0.0805)	0.271*** (0.0911)	0.271*** (0.0923)	0.253*** (0.0931)
Invest	0.265*** (0.0909)	0.271*** (0.0938)	0.251** (0.0968)	0.252*** (0.0946)	0.251** (0.0956)	0.251** (0.0971)	0.217** (0.101)
Open	0.479 (1.128)	0.409 (1.162)	0.347 (1.166)	0.0784 (1.147)	0.0411 (1.179)	0.0404 (1.252)	0.278 (1.263)
Educ	29.01 (26.16)	28.45 (26.39)	29.44 (26.46)	19.25 (26.32)	20.36 (27.42)	20.38 (28.54)	21.56 (28.46)
Govt	-4.748** (1.844)	-4.740** (1.855)	-5.353*** (1.993)	-6.644*** (2.042)	-6.664*** (2.059)	-6.665*** (2.084)	-6.587*** (2.078)
employers	-3.847*** (1.083)	-3.851*** (1.090)	-3.528*** (1.156)	-3.505*** (1.130)	-3.466*** (1.164)	-3.466*** (1.174)	-3.479*** (1.170)
control_corrup		-1.777 (6.198)	-4.915 (7.225)	-2.762 (7.137)	-2.801 (7.188)	-2.798 (7.393)	-1.859 (7.407)
rule_of_law			5.447 (6.412)	10.02 (6.629)	9.691 (6.984)	9.688 (7.363)	9.066 (7.355)
regul_quality				-13.91** (6.560)	-14.33** (7.128)	-14.34** (7.180)	-11.21 (7.596)
gov_effec					1.198 (7.631)	1.199 (7.709)	0.745 (7.692)
pol_sta_viol						0.00477	0.416



						(2.825)	(2.835)
voice_							3.048
							(2.488)
Constant	92.11***	89.94***	103.8***	128.3***	128.6***	128.7***	133.8***
	(32.13)	(33.20)	(37.03)	(38.02)	(38.32)	(38.82)	(38.92)
Observations	90	90	90	90	90	90	90
R <sup>2</sup> -within	0.399	0.400	0.406	0.439	0.440	0.440	0.451
countriess	6	6	6	6	6	6	6

*Note: The values in the parentheses are the standard deviations. \*\*\*, \*\*, \* significant at 1%, 5%, 10%*

*Source: authors*

From the results, in regression (1) mineral rent has a positive and significant impact on per capita growth. This result is contrary to that of Sachs and Warner (1995), who had shown that the abundance of natural resources had a negative impact on growth per capita. This result rejects the natural resource curse hypothesis.

In the same regression, we also show that economic openness and education do not affect per capita growth.

On the other hand, government spending and employment negatively affect the growth in GDP per capita. This result is explained by the fact that governments expenditure of CEMAC member countries are allocated more to consumption goods and these goods are generally imported which does not benefit the national economy.

Likewise, the negative relation of employment to growth per capita can be explained by the fact that jobs are generally created in the less-productive sectors such as the public sector which remains the first employers in CEMAC whereas the informal sector with significant weight in the economy remain face with difficulties.

In regression (2) we introduce a control variable capturing corruption (control\_corrupt). We observe that the latter has no effect on per capita growth. Likewise, the results remain unchanged. So introducing this variable into the regression has no effect.

In regression (3), the introduction of the variable "rule\_of\_law" has no effect. The results are almost identical. On the other hand, in regression (4) the variable "regul\_quality", regulatory quality has a negative and significant effect on growth per capita. But this result is not robust because this variable loses its significance when we introduce the variable voice\_ (regression 7).

The introduction of the variables govt\_effet (government effectiveness) and pol\_sta\_viol (political stability and nonviolence) has no effect in regressions (5) and (6). The results of the first regression remain unchanged.

Taking all institution of governance variables into account in regression 6 confirms the hypothesis that institutions have no effect on the contribution of mineral rent in strengthening growth. The OLS regression has therefore confirm that institutions have no indirect effect on the positive relationship between mineral rent and growth per head. By this, it is necessary to confirm these results using the 2SLS technique.

**Table 3 below presents the 2SLS regression results**

	(1)	(2)	(4)	(5)	(6)	(8)	(9)
VARIABLES	Y	Y	Y	Y	Y	Y	Y
Rent	0.475***	0.490***	0.474***	0.486***	0.536***	0.536***	0.505***
	(0.137)	(0.140)	(0.134)	(0.131)	(0.153)	(0.151)	(0.154)
Invest	0.385***	0.404***	0.361***	0.357***	0.339***	0.342***	0.313***
	(0.108)	(0.112)	(0.109)	(0.106)	(0.103)	(0.104)	(0.109)
Open	-0.216	-0.408	-0.402	-0.677	-0.989	-0.862	-0.640
	(1.192)	(1.236)	(1.216)	(1.191)	(1.264)	(1.298)	(1.308)
Educ	47.79*	47.10*	46.37*	33.97	43.68	41.32	40.57
	(27.98)	(28.10)	(27.58)	(26.99)	(29.28)	(29.65)	(29.21)
Govt	-5.310***	-5.310***	-6.117***	-7.562***	-7.705***	-7.633***	-7.511***
	(1.895)	(1.902)	(2.022)	(2.069)	(2.097)	(2.097)	(2.070)
Employers	-4.488***	-4.518***	-3.983***	-3.937***	-3.546***	-3.526***	-3.530***
	(1.141)	(1.148)	(1.174)	(1.139)	(1.154)	(1.155)	(1.138)
Control_corrupt		-4.236	-8.414	-5.797	-5.999	-6.417	-5.538
		(6.396)	(7.398)	(7.217)	(7.277)	(7.455)	(7.424)
rule_of_law			7.742	12.88*	9.665	10.31	9.858

		(6.493)	(6.707)	(6.919)	(7.247)	(7.158)
regul_quality			-15.94**	-19.81***	-19.69***	-17.26**
			(6.572)	(7.513)	(7.471)	(7.962)
gov_effec				11.32	11.04	10.03
				(8.925)	(8.806)	(8.770)
pol_sta_viol					-0.836	-0.506
					(2.804)	(2.792)
voice_						1.997
						(2.473)
Observations	90	90	90	90	90	90
R-squared	0.329	0.324	0.345	0.383	0.376	0.395
Countries	6	6	6	6	6	6
sargan(j-stat)	0.394	0.393	0.417	0.536	0.589	0.688

*The values in the parentheses are the standard deviations. \*\*\*, \*\*, \* significant at 1%, 5%, 10%*

*Source: Authors*

The table above presents regression results using the 2SLS technique. These results are almost identical to those of the OLS regression.

In regression (1), mineral rent has a positive and significant effect on growth per capita. In this same regression, investment has a positive and significant effect on growth per capita. Any increase in investment increases growth per capita. Furthermore, as in the OLS regression, government spending and employment had negative and significant effects on GDP per capita growth. Unlike the OLS regression, education measured by school enrollment rate has a negative effect on growth, but these results are not robust because in regression (5), when we introduce the variable regulation quality, the coefficient of education becomes insignificant. In this same regression we notice that economic openness has no effect on growth per capita.

In the other regressions, the introduction of the variables capturing institutions or governance does not affect the results. The exploitation of mineral resources captured by mineral rent has a positive and significant impact on growth per capita, contrary to resource curse thesis which shows that the exploitation of natural resources has a negative effect on economic development of countries which have them. In addition, governance and institutions also have no effect on the link between mineral rent and economic development in CEMAC countries.

## 5. Conclusion

The work of Sachs and Warner (1995 1997) opened a wide debate on the relationship between natural resources and development. Researchers are not unanimous on the effect of natural resource exploitation on economic development on one hand and on the transmission channels of these effects on the other. Our study is part of these broad debates between natural resources and economic development. The objective we are pursuing is to determine the effect of the exploitation of mineral resources (minerals and oil) on per capita growth of CEMAC countries, and on the other hand to examine the role of institution of governance in the transmission of these effects over the period 2002 to 2016 which is a period where these member countries experienced a sharp rise in commodity prices at the start of 2000s. This surge in prices has resulted in increased public and private investment together with government spending.

The rise in prices also contributed to the increase in the intensities of trade with the outside world. Moreover, these countries have not been able to withstand two major exogenous shocks. First, the subprime crisis which affected CEMAC economy through the commercialization of natural resources, the demand for which had declined. And a second shock at the end of 2015 due to the fall in oil prices, which fell from US \$ 110 per barrel to around \$ 40. Faced with these shocks, CEMAC countries adopted policies aimed at stabilizing their economies. Note that these two exogenous shocks are coupled with several social crises observed in the zone (the independence war in western Cameroon, the war against the Islamic sect Boko Haram around Lake Chad, attacks by armed gangs in the CAR and Cameroon coup d'état and attempted coup d'état recorded in Equatorial Guinea and CAR). According to Collier and Hoeffler (2005) All these observed grievances are also due to poor governance and inadequate functioning of political and economic institutions. However, to achieve our objectives, we formulate an econometric model in panel data of this economic community based on the literature. The results of our analyzes have shown by the fixed effects method that mineral rent has a positive and significant effect on economic growth. When we control the model by all institution of governance indicators (government efficiency, control of corruption, quality of regulation, political stability / non-violence, rule of law, freedom and responsibility), our results remain robust. This result is also confirmed when we estimated the parameters using 2SLS method. We can therefore conclude that institutions of governance play no role in transmitting the positive effects of mineral rent on per capita growth of CEMAC member countries.

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