

Does the abundance of natural resources increase the economic vulnerability of CEMAC countries?

DASI YEMKWA Gyslin Hermann¹, GOLOUM Magloire², TCHINDA KENGNE Ricardo³

¹ Main Author, Faculty of Economic Sciences and Management, Dschang University, Cameroon

² Co-Author, faculté des Sciences de l'Homme et de la société, Institut universitaire pour le développement international, Cameroon

³ Co-Author, Faculty of Economic Sciences and Management, Dschang University, Cameroon

ABSTRACT

The aim of our study is to determine the direct effect of natural resources on economic vulnerability into CEMAC zone. Three regressions techniques were used for this purpose. First the Fixed Effects (FE); the results by this method showed that natural and oil rent increases economic vulnerability, this result is robust to the Two Stage Least Squared (2SLS) and Maximum Likelihood with Limited Information (LIML) estimators. On the other hand, the mining rent has no effect on economic vulnerability. Moreover, we have shown that mineral rent harm economic vulnerability. At the end of these results, we recommend the reduction and commercialization of natural resources in general and the use of a good part of the said resources in local and national industries.

Keyword: economic vulnerability, natural resources and CEMAC zone

1. Introduction and literature review

After the 1970s oil shocks and the failure of structural adjustment policies, scholars in the 1980s almost agreed that resource-rich economies are “cursed”. It is in this context that Auty (1993) introduced the concept of the natural resource curse into the literature. This idea was popularized by Sachs and Warner (1995).

After the economic crisis of the 70s during the 2000s the world is still hit by an economic crisis: the subprime crisis, born in the USA. The financial policy of the United States of America was the main cause of the outbreak of this economic depression which very quickly affected all the world's economic circuits.

The CEMAC countries have suffered particularly. The financial and economic crisis of 2008 had affected the main levers of growth in African countries. Demand and prices for African commodities have fallen; promises to increase official development assistance made by developed countries have not been fulfilled (AfDB, 2009).

In 2016, a second crisis affected the economy of CEMAC countries. Indeed, after oscillating for several years between 80 and 110 US dollars, the price of a barrel of crude oil began to fall in the second half of 2014. A slight rise was observed in the spring of 2015, thus rising to 60 US dollars per barrel, rise mainly due to the seasonal increase in American demand (the “driving season”¹ from April to September), during which Americans use their vehicles massively to make trips. Prices fell again at the end of the summer. WTI² (West Texas Intermediate) fell

¹ Holiday period, there is an increase in the use of means of transport and therefore an increase in fuel consumption.

² Type of crude oil used as a standard in pricing

below US\$40 per barrel at the end of August 2015. It stood at US\$45 per barrel on September 9, 2015 (DGRIS, 2015).

This crisis also confirms the vulnerability of the CEMAC countries to exogenous shocks and the economic feverishness of the countries of this economic community.

According to Guillaumont (2008, 2009), Cariolle, (2011) economic vulnerability can be understood as the probability that a country's economic development will be slowed down or thwarted by the appearance of unforeseen external events, often called exogenous shocks. Vulnerability economy results from three main determinants: the probability of occurrence of shocks, the exposure of an economy to these shocks and the capacity to withstand shocks (Guillaumont, 2009). While the first two determinants essentially depend on the structural characteristics of the country (geographical location, human capital, economic diversification, etc.), resilience rather depends on the country's current economic policy (Chatri et al., 2019).

The geographical position of countries rich in natural resources, more precisely the distance of these countries from the equator, is a determinant of the curse of natural resources (Omgba, 2016). In addition, a dependence on natural resources has the effect of increasing trade openness and hindering economic diversification (Sachs and Warner; 1995, 1997).

Sub-Saharan African countries remain subject to constraints relating to exposure to shocks. However, this situation in the face of shocks tends to worsen due to the lack of economies of scale, diversification of exports and imports (Ndiaye et al., 2019).

Countries rich in natural resources, more precisely in oil, are less diversified than those poor in these said resources. The vulnerability comes from the fact that CEMAC countries have an economy dependent on the commercialization of natural resources (Ghamisi et al., 2020). However, countries exporting natural resources have no possibility of increasing the prices of their resources.

According to the UNDP (2012) the vulnerability and fragility of "petro_dependent" economies is explained by the fall in the price of oil, the volatility and fluctuation of commodity prices and the effect of the various crises on their economy.

Puloc'h (2020), shares the idea that the fluctuation of world resource prices, in addition to being associated with climate change, makes African economies vulnerable. The more a country is economically vulnerable, the less its growth seems sustainable or sustainable, all other things being equal. But the sustainability of growth does not only depend (negatively) on vulnerability to shocks; it also results from more permanent factors, such as the accumulation of physical and human capital and the preservation of natural resources.

On the theoretical level Novak explains the economic vulnerability of countries rich in natural resources by the Dutch disease. The Dutch disease theory seeks to provide logical reasoning on the fact that the exploitation of an important natural resource in a country can lead, contrary to the expected advantages, rather to a disadvantage for the country. More concretely, the Dutch disease therefore refers to the shock that an economy may suffer following the exploitation of an important natural resource. This phenomenon will result in the decline of activities in this sector, unlike other sectors of the economy, because all intentions and even attention will be focused on this new sector of activity. What should be an opportunity, a blessing for the harmonious development of countries producing natural resources, becomes a double-edged sword because the revenues generated from exploitation negatively affect the structures of the economy through certain production sectors, as well as income distribution (Nakoumde, 2007).

The economic vulnerability would come from the fact that, following a "boom", the sector exposed to international competition will be less competitive; because production costs will be higher than those abroad (Novak).

Studies on natural resources in general pay very little attention to the direct link between exploitation and vulnerability. Our aim is to empirically verify whether natural resources in the CEMAC positively affect the economic vulnerability of the countries of this community. We postulate that the exploitation of natural resources captured by rent is one of the causes of high vulnerability of CEMAC countries.

The remainder of our article will be organized into two sections. The second section focuses on the stylized facts of natural wealth and vulnerability factors in CEMAC. The third section is reserved for the empirical analysis of the direct effect of natural rent on the economic vulnerability of CEMAC countries.

2. 2. Natural wealth and economic vulnerability in CEMAC countries: some stylized facts

2.1 Natural wealth of CEMAC countries

CEMAC countries are ranked among the largest exporters of natural resources. Their subsoil is full of mineral resources such as bauxite, iron, cobalt, manganese, nickel, gold, uranium, silver, potash, diamond, copper, useful stones (marble, limestone, pozzolan), tungsten, niobium, etc.

Cameroon, for example, is counted among the top 10 countries in the world with bauxite reserves. Gabon is ranked among the top three manganese producers in the world with 30% of world reserves. For iron, the reserves of Gabon, Cameroon and Congo are estimated at more than 500 million tonnes (CEMAC, 2009).

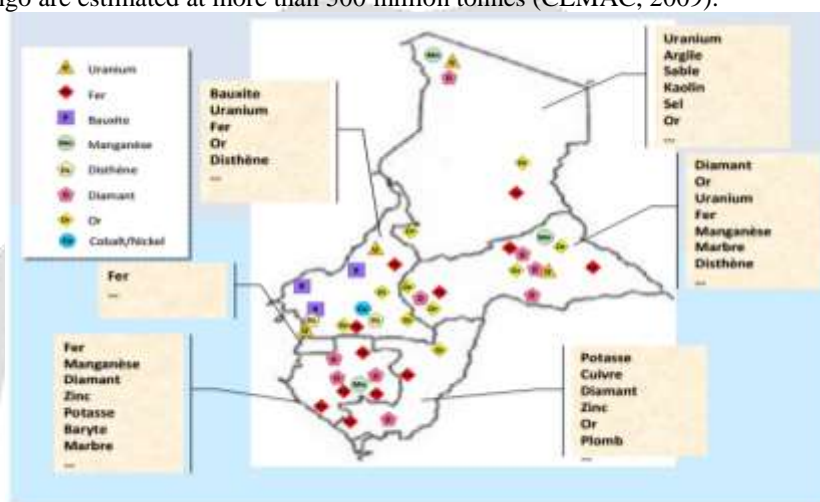


Figure 1: CEMAC mining map

The subsoil of Chad and the CAR is also home to precious metals such as gold and diamonds. Equatorial Guinea is the only country in CEMAC that does not exploit minerals. Similarly, the CAR is the only country in the economic community that does not exploit oil.

However, the CEMAC countries are also recognized as very large exporters of oil from Africa. 4 CEMAC states are in the top 10 oil producers on the continent. The leading oil-producing CEMAC country is Congo Brazzaville with a production of 278,000 barrels/day, which represents 3% of African production. The Congo ranks sixth among African oil-producing countries. It is overtaken by countries such as Algeria, Libya and Egypt.

The second CEMAC country ranked among the largest oil producers is Equatorial Guinea with a production of approximately 268,000 barrels/day; this represents nearly 3% of total African production, which places the country in seventh place in Africa and 35th (in the ranking) worldwide.

Gabon and Chad are respectively ranked 9th and 10th producers in Africa with each a production of 213,000 and 120,000 barrels per day and representing 2% and 1.4% of African production. In the world ranking, these two countries appear in 37th and 44th place. Cameroon is the biggest absentee from this ranking (of the 10 oil-producing countries).

Classement Africain	Classement mondial	Pays	Production en 2015 (en milliers de barils/jour)	Poids dans la production africaine
1	13	Nigéria	2 322	27%
2	16	Angola	1 856	22%
3	18	Algérie	1 671	19%
4	27	Egypte	707	8%
5	30	Lybie	461	5%
6	34	Congo (Brazzaville)	278	3%
7	35	Guinée Equatoriale	268	3%
8	36	Soudan & Sud Soudan	262	3%
9	37	Gabon	213	2%
10	44	Tchad	120	1,4%
mays-mouissi.com		Total	8 158	100%

Table 1: Top 10 African oil producing countries

However, Cameroon's oil reserve is considerable. According to a study made in 2003 "BP statistical review of world energy"³, Cameroon would have an oil wealth estimated at nearly 0.2% of African reserves.

It is hard to believe that with this natural potential, the CEMAC countries remain underdeveloped. To fully understand the current economic situation of CEMAC, and the different strategies implemented for their development, it is necessary to trace the economic profile of the countries of this economic community since their independence.

2.2 Economic vulnerability of CEMAC countries

In less than 10 years, the CEMAC countries have been significantly hit by the last two economic crises (the subprime crisis and the recent oil crisis of 2015) these crises have had an impact on the growth and the budget balance of these countries there, because we have seen a budget deficit in the countries of this community and a drop in GDP growth.

The sectors most affected by the financial and economic crises of 2008 are: the extractive sector because of demand and oil prices in particular, the tourism sector, the textile sector and the manufacturing sector. This will lead to an increase in unemployment, as several national and international companies operating in this sector have had to file for bankruptcy or reduce staff.

In addition, the second crisis that considerably affected the CEMAC countries is that of 2015. This crisis was triggered by the drop in oil revenues (see Figure 8). It particularly affected countries dependent on oil resources.

Three main causes of this fall in prices can be revealed: first, the slowdown or even fall in global demand, due to the stagnation of national economies, in particular those of emerging countries such as China, Brazil, South Korea, and India, which until now were the major oil consumers in the world. Second, the increase in oil production in countries such as the USA and Canada, which have embarked on the exploitation of oil from shale (in the USA), and from the oil sands (Canada).

³ British Petroleum Company Review

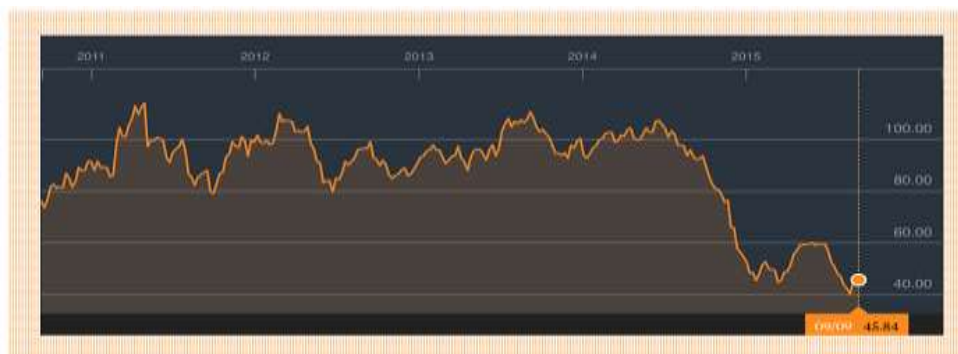


Figure 2: Evolution of crude oil price between September 2010 and September 2015

Thus increasing their production from 6.8 million barrels per day in 2006 to 11.6 million barrels per day in 2014 in the USA and an increase in production of 3.2 million barrels per day in 2009, to 4, 3 million barrels per day in 2014 in Canada (DGRI, 2015). Thirdly, the political instability and the rise of terrorism in countries such as Libya, Syria and Iraq, where there had been a clandestine over-exploitation of oil resources and commercialization for the acquisition of arms by the terrorists from those countries.

Faced with the crisis due to the fall in the prices of raw materials, in particular oil, cocoa, coffee, bananas, etc. the Heads of State of the CEMAC countries met in extraordinary session in Yaoundé on December 23, 2016, to undertake economic and financial reforms and consider ways to end the crisis.

In addition to the problems related to the price of raw materials, several other points were placed on the agenda such as the security and political crisis: Cameroon and Chad are observing a situation of insecurity due to attacks by the terrorist sect Boko Haram; the situation of Nigerian and Central African refugees, respectively in North and East Cameroon, the post-electoral crisis in Gabon, and the economic partnership agreements between EU and ACP countries; were matters of concern.

Indeed, we witnessed the entry into force of the EPAs between Cameroon and the EU; who had ratified them some time before. Given that the EPAs constitute an opportunity for the modernization of the CEMAC economy. But to benefit from the advantages of the EPAs, several constraints must be lifted, mainly the modernization of the industrial sector, by making it more competitive. This modernization will allow the reduction of production costs and the conquest of important markets; then it would result in an increase in production for the regional and international market.

Moreover, the prices of domestic products sold on the domestic market would fall under the effect of greater competitiveness and the fall in imports. At the commercial level, the EPA presents an opportunity for all CEMAC countries, which could increase their market share in the EU, provided that they produce in good quality and in good quantity and above all, at a lower cost.

It should be recalled that Cameroon is part of the logic of the process of trade negotiations, started since the end of the 1950s with the Treaty of Rome and which successively gave rise to several conventions between Europe and the countries of the ACP: The Cotonou Agreement was concluded in June 2000 as an element of consensus in trade relations between the two groups (PRC, 2016).⁴

Likewise, this process is also in line with the negotiation within the framework of free trade, foreseen in the African Union's Agenda 2063, aimed at establishing a customs union and a continental free trade area (CFTA).

Most of the other Regional Economic Communities seem to have a common position on a set of given points on the establishment of the CFTA; but, the CEMAC countries are still illustrated by different understandings for each State.

⁴ Presidency of the Republic of Cameroon

However, the polarization of their economies, largely based on exports of basic raw materials, led to a decline in the CEMAC growth rate, which stood at -0.4% in 2016 against 1.8% in 2015. It strengthened slightly to 0.4% in 2017, driven by an improvement in the terms of trade (14.8%) and the implementation of reforms, mainly within the framework of the Reform Program Economic and Financial Affairs of CEMAC (PREF-CEMAC) and programs with the IMF.

In addition, several measures have been taken by governments to address the budget deficit and financial constraints in CEMAC. Countries have undertaken programs with the IMF. This program had been badly perceived by the populations in general, because it reminds us of the Structural Adjustment Plans of the 90s which had a negative impact on the life of the populations.

In order to cope with exogenous shocks and to facilitate the integration of CEMAC member countries in the African region and even in the Central African sub-region, the member States of this organization have set up by mutual agreement, a system of multinational monitoring. Convergence criteria have been adopted by member countries (see appendix).

3. Methodological Approach

3.1 Formulation of the empirical model

To determine the effect of natural resources on the economic vulnerability of CEMAC countries, we formulate a panel econometric model.

$$\text{Vul}_{it} = a_0 + \alpha \text{Rent}_{it} + \sum \beta Z_{it} + \mu_{it} \quad (1)$$

In this formulation, "Vul" is the logarithm of the measure of economic vulnerability, "Rent" is the matrix made up of 3 different rents, namely.

- The total resource rent (totale_rent)
- Oil rent (oil_rent)
- Mineral Rent resource rent (mineral_rent)

"Z" the matrix of control variables consisting of:

- The control of corruption indicator (control_corrupt)
- Life expectancy
- The number of telephone subscriptions per year, taken in logarithmic value (Tel)
- Access to financial institutions (FIA)
- The depth of the financial market

The general model therefore takes the following form:

$$\text{Vul}_{it} = a_0 + \alpha \text{Rent}_{it} + \beta_1 \text{esperance}_{it} + \beta_2 \text{Tel}_{it} + \beta_3 \text{fia}_{it} + \beta_4 (\text{fmd})_{it} + \beta_5 \text{control_corrupt}_{it} + \mu_{it} \quad (2)$$

In this formulation, “ a_0 ” represents the constant “ μ it” the error term, $i=1,\dots,6$, the CEMAC countries and $t=1,\dots,15$ years. Taking into account the different annuities. The below table give a summary of data’s use in the study.

Variable	Obs	Mean	Std. Dev.	Min	Max
Total_rent	90	26.824	16.795	5.748	59.604
Oil_rent	90	20.926	17.593	0	57.413
Mineral_rent	90	.052	.061	0	.308
Espérance	90	54.791	5.737	43.718	66.105
Control_corrup	90	-1.188	.266	-1.813	-.591
fmd	90	.024	.029	0	.13
fia	90	.146	.256	0	.83
TEL	90	99935.598	240612.98	800	1156230
VUL	90	33.95	10.119	17.697	54.699

Table 2: Descriptive Statistics

The table of descriptive statistics shows us that the total rent of natural resources represents nearly 27% of the GDP. Similarly, oil alone has a proportion of 21% of the domestic product, as long as minerals are less than 1%. The life expectancy of CEMAC populations is on average about 55 years. In addition, there are on average 99,935 new telephone subscribers per year in CEMAC.

The control of corruption indicator is very low showing a high level of corruption in CEMAC.

Variables	Definition	Sources
Economic Vulnerability (VUL):	Economic VULNERABILITY is the probability that the economic development of a country could be thwarted by an external shock According to Guillaumont (2008, 2009).	FERDI (2020)
Natural Resource Rent (Rent)	According to the World Bank (2018) Resource rents correspond to the difference between the value of the production of a stock of raw materials and their total cost of production. It is calculated as a percentage of GDP.	WDI(2018)
Corruption control (Contro_corup)	Reflects perceptions of the extent to which public power is exercised for private gain, including minor and major forms of corruption, as well as the perception that elites and the private sector have of the state.	WGI(2018)
Telephone subscription (Tel)	Average number of people requesting a telephone subscription per year.	WDI(2018)
Life expectancy (Expectation)	Captured by the average number of years an individual can live on earth.	WDI(2018)
Financial market depth (fmd)	It is the indicator that allows an investor to know how easily it is possible for him to buy or sell his securities without causing a significant variation in prices.	FMI(2018)
Access to the financial market (fia)	It refers to the ability of a company or a country to sell goods and services across borders.	FMI(2018)

Table 3: Definition and source of variables

3.2 econometric technic

For more robustness, three parameter regression techniques will be used. First, fixed effects. Panel data models are distinguished by the inclusion of the “individual effect” or “unobserved individual heterogeneity”, which allows the behavior of each individual to be differentiated. A distinction is made between fixed effects (FE) and random effects (RE) models; the difference between these two types of models lies in the correlation (case of FE models) or non-

correlation (case of RE models) between the unobserved individual effect and the repressors of the FE model. The advantage of analyzing this type of data is that it allows modeling heterogeneity between panel groups or individual heterogeneity.

The estimation of these two types of models raises certain issues. For fixed-effects models, the problem of incident parameters makes the maximum likelihood estimator non-convergent; random-effects models, on the other hand, require a very restrictive assumption about heterogeneity with respect to its zero correlation with the observed variables included in the model (Greene, 2005).

Secondly, the 2SLS method is widely used when in the empirical model, at least one explanatory variable is endogenous. In our case, the mining rent variable that we will use as a measure of NR abundance or exploitation is assumed to be endogenous. A source of endogeneity is the presence of a restarted dependent variable as an explanatory variable. In this case, this variable is correlated with the error term, which is a contradiction with the postulates of linear regression. The principle of this method is to use one or more instrumental variables not correlated with the endogenous variables, but not with the error term.

Third, the maximum likelihood method with limited information. It was first introduced by Anderson and Rubin in 1949, long before the 2SLS. However, MIML is also an instrumental variable estimation technique similar to 2SLS. It uses instruments to correct the endogeneity problem.

2SLS has been preferred by researchers to MVIL as a method for parameter estimation. However, if the equation to be estimated is exactly identified, these two methods provide similar results. Recent studies by Hahn and Inoue (2002) have shown that the MVIL provides more reliable results when we are in the presence of “weak” instruments.

3.3. Results and discussions

Table 4 below presents the results of the estimation of equation 2 by the fixed-effect method.

VARIABLES	(FE) vul	(FE) vul	(FE) vul
total_rent	0.00315** (0.00138)		
Oil_rent		0.00328** (0.00137)	
Mineral_rent			-0.379 (0.241)
espérance	-0.0175*** (0.00483)	-0.0175*** (0.00504)	-0.0125** (0.00573)
fmd	-1.096* (0.640)	-1.199* (0.646)	-1.961*** (0.503)
fia	1.341*** (0.363)	1.367*** (0.374)	1.118*** (0.351)
control_corrup	0.157* (0.0879)	0.148 (0.0909)	0.181* (0.0936)
tel	-0.0330** (0.0153)	-0.0338** (0.0157)	-0.0299* (0.0156)
Constant	4.705*** (0.270)	4.691*** (0.282)	4.587*** (0.303)
Observations	90	90	90
R-squared	0.451	0.440	0.432

Number of pays 6 6 6

Table 4: economic vulnerability and natural resources: the FE approach

Note: Robust standard errors are indicated in parentheses. (***, **, *) indicate statistical significance at 1%, 5% and 10%.

The results of the regression using the fixed effects method show us that the total rent of natural resources increases the economic vulnerability of CEMAC countries. Any increase in the natural rent of the unit has the effect of increasing the vulnerability by approximately 0.003 units. Indeed, the natural rent exposes the economy of the CEMAC to exogenous shocks, this is the case of the financial crisis of 2008 which had affected this economic zone through trade in natural resources. The economic feverishness also comes from the fact that the export of natural resources weakens the sectors producing manufactured goods (Nakoumde, 2007). The exploitation of an important natural resource in a country can lead, contrary to the expected advantages, rather to a disadvantage for the country. More concretely, following the exploitation of an important natural resource, the national economy can suffer an exogenous and endogenous shock. This is manifested by the decline in activities in this manufacturing sector, because all intentions and even attention will be focused on this new sector of activity. What should be an opportunity, a blessing for the harmonious development of countries producing natural resources, becomes a double-edged sword.

Dependence on natural resources weakens domestic industries producing goods for export and increases imports, leading to a deficit in the balance of trade (Gregory, 1976).

In regression 2 we also show that oil also increases vulnerability. This result is consistent with that of regression 1. Oil alone represents more than 20% of CEMAC's GDP, and is marketed crudely and exploited industrially. On the other hand, mining resources (minerals) are generally exploited in an artisanal way and a good part transformed locally. It is for this reason that we do not observe any effect between mining rent and vulnerability. In addition, minerals represent a small proportion of CEMAC's GDP; because its exploitation is still embryonic.

In addition, the life expectancy of populations reduces vulnerability. The longer a person lives, the more he participates in economic development. Longevity also reflects the state of health of a population.

The number of telephone subscriptions also reduces economic vulnerability. Indeed, the telephone is a communication tool and device that allows efficient management of activities. In addition, thanks to the internet connection, it facilitates quick access to information. Thus, it is easier for an economy to learn about the economic situation of a State and to take measures in time to deal with adverse exogenous effects.

Our main results are confirmed by the Two Stage Least Squared (2SLS) method.

VARIABLES	(1) vul	(2) vul	(3) vul
total_rent	0.0107*** (0.00364)		
Oil_rent		0.0158*** (0.00546)	
Mineral_rent			-1.878** (0.915)
espérance	-0.0184*** (0.00552)	-0.0173** (0.00715)	0.00593 (0.0127)
fmd	1.169 (1.222)	2.262 (1.678)	-1.663*** (0.620)
fia	1.985*** (0.499)	2.378*** (0.671)	1.291*** (0.428)

control_corrup	0.210** (0.103)	0.187 (0.130)	0.362** (0.153)
tel	-0.0363** (0.0176)	-0.0406* (0.0224)	-0.0227 (0.0190)
Observations	90	90	90
R-squared	0.429	0.618	0.040
Number of pays	6	6	6
Sargan	0.2480	0.6338	0.168

Table 5: Natural resources and economic vulnerability: 2SLS approach

Note: Robust standard errors are indicated in parentheses. (***, **, *) indicate statistical significance at 1%, 5% and 10%.

Several of our results are confirmed when we take into account the criticism of Van der Ploeg and Ploekke (2010), according to which the variable rent formulated by the World Bank is all the more endogenous than the variable intensity of resources on GDP of Sachs and Warner (1995, 1997).

In table 5 column 1, total resource rent has a positive effect on vulnerability, as does control_corrup and financial market depth (fmd). On the other hand, life expectancy and the number of telephone subscriptions reduce vulnerability. These results are similar to those of regression 2. In regression 3 the results show that mineral rents reduce the economic vulnerability of CEMAC countries. This result is contrary to that of the fixed effects regression. The DMCs show us that mining rent, unlike other forms of rent, reduces vulnerability in the CEMAC. The process of exploiting said resources and using them in local industry reduces the risk that an exogenous shock will thwart the economic development of CEMAC countries. these results were confirmed by the maximum likelihood method with limited information (appendix).

4. Conclusion

From 1970, the CEMAC countries have been hit hard by four crises of external origin. The economic structure of these countries has not made it possible to curb the harm caused by these exogenous shocks. To deal with this, the member states of this organization have set up, by mutual agreement, a multinational surveillance system. Convergence criteria have been adopted by member countries. This did not prevent the 2015 oil crisis from disrupting their economies. Hence our concern, whether natural resources do not increase economic vulnerability in this economic zone. Our empirical results have shown that the natural resource rent positively affects the economic vulnerability of CEMAC countries. In other words, the commercialization of natural resources results in an increase in economic vulnerability. Taking into account two different natural resources in this case oil and minerals. The results show that oil increases vulnerability unlike minerals. This is explained by the fact that minerals, unlike oil, make a weak contribution to growth. In addition, the minerals are extracted in a traditional way for a good part, and is used in the raw state in local industries. At the end of our results, we recommend firstly, the reduction of the dependence of the economies of the CEMAC on natural resources precisely, lowering the production and the marketing of the said resources. Secondly, the use of a share of resources in local or national industries.

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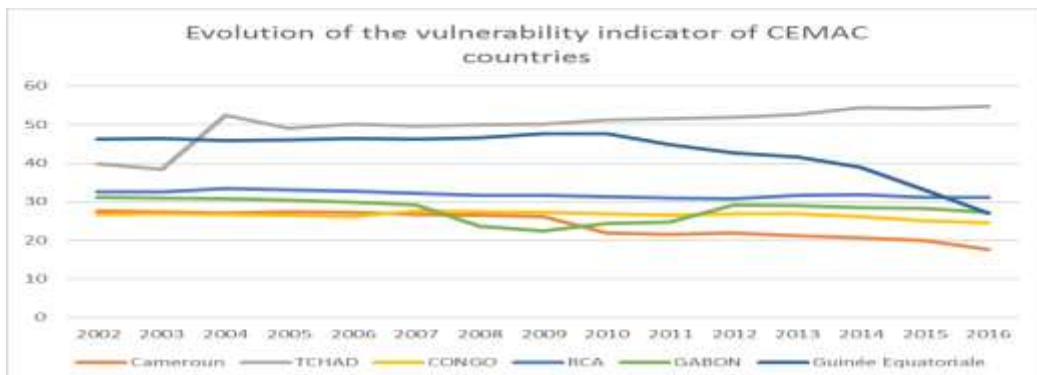
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Appendix

Critères	Seuil
Critères de 1^{er} rang	
1. Solde budgétaire de base (en % du PIB)	≥ 0
2. Taux d'inflation annuel	$\leq 3\%$
3. Encours de la dette publique (en % du PIB)	$\leq 70\%$
4. Accumulation des arriérés (extérieurs et antérieurs)	$= 0$
Indicateurs de 2^d rang	
1. Masse salariale / recettes fiscales	$\leq 35\%$
2. Investissements financés sur ressources intérieures sur recettes fiscales	$\geq 20\%$
3. Solde extérieur courant de base (en % PIB)	$\geq 5\%$
4. Taux de pression fiscale	$\geq 17\%$
5. Taux de couverture extérieure de la monnaie par les avoirs de change	$\geq 20\%$

Appendix1, Source : Laffitau et Edi (2014)



Appendix2 : Evolution of the vulnerability indicator of CEMAC countries

VARIABLES	(1) vul	(2) vul	(3) vul
total_rent	0.0115*** (0.00388)		
Oil_rent		0.0161*** (0.00558)	
Mineral_rent			-1.968* (1.525)
espérance	-0.0185*** (0.00568)	-0.0173** (0.00724)	0.0193 (0.0202)
fmd	1.383 (1.293)	2.344 (1.713)	-1.446* (0.826)
fia	2.046*** (0.520)	2.402*** (0.683)	1.416** (0.565)
control_corrup	0.215** (0.106)	0.188 (0.131)	0.493** (0.229)
tel	-0.0366** (0.0181)	-0.0407* (0.0227)	-0.0176 (0.0250)
Observations	90	90	90
R-squared	0.485	0.450	0.412
Number of pays	6	6	6
Sargan	0.6357	0.1423	0.0659

Standard

errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix 3: economic vulnerability and natural resources: the FE approach