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Governance, Infrastructure and Regional Integration: The Case of CEMAC

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Abstract

The objective of this study is to determine the effects of governance and physical infrastructure on regional integration, more specifically trade integration in the CEMAC region. The approach used is based on the gravity model augmented with the Pseudo Maximum Likelihood method of the Fish Law (PPML). This model is estimated on a panel of Economic and Monetary Community of Central Africa (CEMAC) countries and its main partners over the period 2006-2016. The results thus obtained show that governance is a barrier to integration and maritime openness has a positive and significant effect on trade integration. It has resulted in 7.7 times the community's trade.

Keywords

Governance, Infrastructure, Regional Integration and CEMAC

1. Introduction

In recent years, trade concerns in a region have revived the debate on the importance of governance and infrastructure in regional integration (Ramli & Ismael, 2014; Portugal-Perez & Wilson, 2012). In general, governance includes the traditions and institutions through which power is exercised in a country. This includes the process by which governments are selected, controlled and replaced; the ability of government to formulate and effectively implement sound policies; and respect for citizens and the state for the institutions governing economic and social interactions between them (North, 1990).

In economic theory, there is no unanimity on the definition of the concept of infrastructure as it is likely to cover very different realities (Gramlich, 1994). Thus, infrastructure is a heterogeneous set of capital goods that can be grouped into four areas, including water and sanitation, energy, transport and telecom-

munications. These infrastructures play a dual role in promoting development as a factor of production by reducing costs and increasing the level of infrastructure services offered, then as basic services, some of which are considered fundamental rights (Kane, 2011).

The integration of a region varies with the ease with which people, goods, services and capital can move between its members. But when a country or sub-region does not have sufficient transport infrastructure, it no longer fulfils its connectivity function and the economy suffers. Thus, the effects of trade creation and especially market integration can be reduced because essential transactions and relationships are delayed or disrupted. In addition to these effects, it should also be noted that transport costs may increase as exporters lose time to trade and this affects the country's competitiveness (Hildegunn, 2006). This analysis contradicts the dynamic integration approach, which considers that the expected effects of an integration process are likely to change the conditions for economic growth through the reduction of transaction costs.

In developing the geographical economy, Krugman (1994) shows that transport infrastructure, as factors of economic growth, plays a significant role in explaining the centripetal (agglomeration effects) and centrifugal (dispersion effects) forces that define the economic organization of territories. Through this analysis, Krugman (1994) shows that distance are a barrier to trade.

Nowadays, with the development of ICTs, geographical distances no longer pose a major problem for trade (Cairncoss, 2001; Artus & Cette, 2004). Telecommunications then play an important role in international trade because they facilitate digital transactions, distance buying and selling. ICTs facilitate trade by reducing transaction costs, customs clearance times and waiting times for goods at borders and ports. In addition, they allow better communication between producers and consumers, improved access to market information, electronic payment, etc.

As a result of these debates, many other authors (François & Manchin, 2013) have shown that infrastructure alone cannot facilitate trade flows and promote development. Border facilities, such as customs, immigration offices resulting in administrative and regulatory deficiencies, create bottlenecks that prevent infrastructure assets from providing appropriate services and constitute barriers to trade (Teravaninthorn & Raballand, 2008). Consequently, the institutional framework is crucial to trade because it has an incentive and positive function on economic behaviour (Anderson & Marcouiller, 2002; François & Manchin, 2013).

Empirically, several studies (Limao & Venables, 2000; Ramli & Ismael, 2014; Portugal-Perez & Wilson, 2012) have shown the positive effects of transport and telecommunications infrastructure on trade and the effects of institutions on trade (Lavallée, 2006) using the Anderson & Van Wincoop (2003) gravity model. But to our knowledge, there is a lack of studies that have sought to address the governance effects of infrastructure in a poorly integrated area such as the Eco-

nomic and Monetary Community of Central Africa (CEMAC). This is why this paper aims to fill this gap by focusing on this literature. In addition, this theme is of practical interest because it complements the vision sought by the CEMAC countries since 2008, which is that of an integrated and emerging regional economy. In the light of the Continental Free Trade Area (ZLEC), which covers trade in goods, services, investment, intellectual property rights and competition policy, the choice of CEMAC as a field of investigation can be justified for at least three (3) main reasons.

First of all, intra-regional trade in this sub-region is barely 2%[1]. In 2010, for example, intra-EU trade contributed 2.1% of countries' total exports (including intra-EU exports) and 3.9% of imports. These levels are low compared to similar regional groupings such as WAEMU where EU trade accounted for 11.5% of imports and 15% of exports in 2010[2]. Intra-Community trade is very unevenly distributed between Member States. Indeed, the combined share of Cameroon, Gabon, Congo and Equatorial Guinea amounts to no less than 95% of total intra-Community exports. The contribution of the two (2) landlocked CEMAC countries, Central Africa Republic and Chad, is minimal, less than 5% of intra-Community exports[3]. In 2016, total trade represents only 8% for total exports from the CEMAC zone and 6.4% of imports. By way of comparison over the same year, the export and import statistics are respectively around 19.3% and 19% for the WAEMU zone. This inventory may reflect a low level of trade integration of these countries.

Second, in CEMAC, road transport accounts for 90% of interurban transport, but the physical links and services offered are insufficient. Transport costs remain high, much higher than in other developing regions. They represent on average 14% of the total value of exports compared to 8.6% for all developing countries and are even higher for many landlocked countries such as Chad[4]. According to Tervaninthorn & Raballand (2009), considering the Douala-N'Djamena corridor for a distance of 1830 Km, it takes 12 - 15 days to reach the destination at a cost of 200 - 210 per tonne in dollars and, for the Douala-Bangui corridor (1450 Km), it takes 8 - 10 days. The port of Douala then plays an important role in sub-regional integration because it is through it that most of the landlocked countries' export and import products pass. The resulting trade (import + export) is estimated at 6727 million US$[5]

In terms of communication infrastructure, although it plays an undeniable role in trade, CEMAC countries are still lagging behind in this regard. For example, in 2013[6], for all the countries in the area, 7.4%[6] of individuals have access o the Internet (per 1000 inhabitants). Telephone connectivity is poorly available.

[1]UNCTAD (2011).
[2]WTO (2013).
[3]http://www.cemac.int/node/44: Towards an integrated and emerging regional economy, Regional Economic Programme, volume2.
[4]https://www.uneca.org/oria/pages/eccas-trade-and-market-integration
[5]African Development Bank (2010).
[6]Authors calculations from http://www.itu.int/net/ITU-SG/regional-fr.aspx

For example, for a population of 100 people, the fixed telephone use rate is 3.59% in Cameroon, 0.02% in Central Africa, 0.35% in Congo, 0.24% in Chad, 1.15% in Gabon and 1.96% in Equatorial Guinea.

Finally, for all these physical infrastructures, the institutional framework does not allow for integration through trade. Landlocked countries (Chad and Central Africa) face significant difficulties when they have to transit mainly through neighbouring countries to access then nearest port because of various trade barriers, which may still raise questions about the effects of integration. For example, administrative procedures within CEMAC extend the transport time of exports and imports by 20%[7]. Such a situation may imagine the absence of free trade in this community. In addition, according to the Mo Ibrahim (2016) ranking, no CEMAC country ranks high in the ranking, reflecting the fragile state of governance-related institutions.

This study highlights the effects of governance and physical infrastructure on regional integration, more specifically trade integration, focusing on the case of the Economic and Monetary Community of Central Africa (CEMAC). Specifically, it is first of all a question of determining the effects of transport and telecommunications infrastructure on integration and secondly, of demonstrating the contribution of governance to integration.

2. Literature Review

This section presents the theoretical and empirical debates that have led to an understanding of the role of governance and infrastructure in regional integration.

2.1. Review of Theoretical Literature

Transport infrastructure is at the heart of the choices for the location of economic activities and largely explains the economic disparities between regions. Materialized by ports, airports, roads and railways, these operate as a network that can often be assimilated to technical support for economic intermediation. To this end, these infrastructures are of crucial importance for trade by facilitating the mobility of people, goods and the development of trade.

By facilitating trade, transport infrastructure allows countries to have the opportunity to increase their trade when market integration is advanced. According to Michel & Prud'homme (2007), easier trade makes for more intense trade, and more intense trade produce more wealth. The intensification of trade due to physical integration can therefore easily meet the economic effects of integration, particularly the creation of traffic.

Transport infrastructure meets a direct need of the population. But they also have a major economic function, which consists in lowering the costs of producing and distributing goods. By reducing the cost of trade and travel, transport infrastructure can increase the volume of trade. Consequently, the cost of the time required to transport goods also becomes an essential component in trade (Hummels & Schaur, 2013).

[7]FDA (2010).

Based on the geographical economy, Krugman (1994) examines the role of transport infrastructure in the formation of agglomerations and major centres of concentration. Geographic economics refers to spatial organization since economic activities are not all located in the same place even if there is economic integration. As a result, the realization of economic interactions involves the movement of individuals, inputs or commodities (Prager & Thisse, 2009).

In general, two (2) laws characterize the geographical economy. The first law stipulates that "not all activities can be present everywhere". On this basis, the connection of a country to an external market through maritime and airport infrastructure remains important. On the other hand, the second law (Tobler, 1979) states that "what happens near us is often more important than what happens far from us". This law highlights the primal importance of proximity in defining interrelationships in space. It can therefore show that other modes of transport (road and rail) occupy a marginal portion of international transport since they are national or regional in scale.

The role played by transport infrastructure is complemented by telecommunications. Indeed, telecommunications affect all economic and social activities, redefining notions of space and time and tending to transform the ways of producing, exchanging, communicating and learning. In this respect, ICTs are at the origin of an "economic revolution" that Artus (2001) defines as a set of upheavals, mutations and new mechanisms governing economic activity over the last twenty (20) years.

The development of ICTs has given rise to tools that create connectivity between partners through the use of the Internet. These include e-commerce. These forms of distance learning activities avoid the displacement of individuals and create new social relationships at the global level. Moreover, e-commerce has enabled some companies, specifically service companies, to reduce costs through direct sales, better target potential customers, and offer personalized services (Bakos et al., 2005).

These previous theoretical developments simply show the place of infrastructure in integration. However, trade can only develop within an appropriate institutional framework within which freedom and security of transactions are guaranteed (Lavallée, 2006). Analysis on governance generally shows that the good quality of institutions positively affects economic performance (Clague et al., 1996; Anderson & Marcouiller, 2002). Indeed, a better quality of institutions makes it possible, through openness, to increase trade and encourages countries to implement measures that enable them to benefit from it (better competitiveness, growth, etc.). It is therefore essential for the state to put in place regulatory measures that can protect the general interest. Thus, inefficient bureaucracy has a positive influence on the conduct of business because it contributes to the elimination of arbitrariness and inefficient policies. It also contributes to improving the delivery of public services to businesses to make them more productive. Another consequence of this performance is the reduction of uncertainty and the effective and equitable application of the necessary public regulations.

Anderson & Marcouiller (2002) show that the low quality of domestic institutions reduces bilateral trade by increasing the risks and uncertainty associated with international transactions. Thus, the uncertainty associated with poor quality institutions acts as additional costs for the economic operator and penalizes exports (Anderson & Marcouiller, 2002). In particular, the importer needs to be reassured that he will receive his order on time with a very high probability. If the supplier abroad has good quality institutions, this is possible. On the other hand, the similarity in the nature and quality of institutions would facilitate bilateral trade by improving the ability of the exporter and importer to adapt to the institutions of their partner (Lavallée, 2006).

2.2. Review of Empirical Literature

Empirically, Limao & Venables (2000) showed that poor road infrastructures accounts for 40% of transport costs in not landlocked countries and 60% in the case of landlocked countries. These results can reflect the cost of connectivity explained by the quality of infrastructure for coastal and non-coastal countries. This is particularly relevant in the case of African countries where, at equal distance, transport costs appear particularly high due to geography and poor infrastructure. On the other hand, by conducting a study on the determinants of transport costs in Central Africa, Tervaninthorn & Raballand (2009) showed that although the road conditions on the N'Gaoundéré-Moundou corridor are better, the transport price remains high. This result challenges previous empirical analyses. Indeed, these authors explain this situation by the absence of market regulation.

According to World Bank (2009), being landlocked increases land distribution by four days for exports and nine (9) days for imports, compared to an equal distance travelled in a country with a maritime opening. This result corroborates the previous analysis that isolation is an obstacle to supply. Nevertheless, since transport infrastructure is a source of spatial externalities, landlocked countries benefit from the infrastructure of their neighbours to access the regional market.

The trade effects of transport infrastructure were also studied by Ramli & Ismail (2014) in ASEAN-5 (Indonesia, Malaysia, Thailand, Philippines and Singapore) over the period 1989-2009. They are based on the enhanced gravity model with a panel approach and obtain the results that transport infrastructure (roads, rail, sea and airport) provides better connectivity between these countries and has significant and positive effects on their exports. Such a result was also obtained by Ahmad et al. (2015) for Malaysia over the period 1980 to 2013. Portugal-Perez & Wilson (2012) study the effects of physical infrastructure (hard infrastructure) and institutional infrastructure (soft infrastructure) on the export performance of 101 countries over the period 2004-2007. These authors used different estimation approaches, including two-step Heckman and the Maximum Pseudo Likelihood of the Fish Law (PPML). According to their results, physical infrastructure has positive effects on export performance. For example,

a 1% increase in the level of transport infrastructure in Algeria leads to an 18.8% increase in exports.

Kepler & Manchin (2007) conduct a study on a group of countries over the period 1988 to 2002 to analyse the effects of the quality of institutions and physical infrastructure on trade flows. However, they calculate a composite telecommunications index that takes into account the Internet, mobile and fixed telephone to assess the effects of e-commerce. Based on a gravity model with an approach using Heckman's (1979) two-stage selection model, the results of these authors showed positive effects of telecommunications on trade over the period considered.

At the end of this literature review, it appears that there is a lack of studies on work including governance and infrastructure for a sub-region as less integrated as CEMAC. It therefore seems appropriate to reflect on such a subject.

3. Methodology

The gravity model is one of the most widely used means of explaining the determinants of international trade and regional integration (Carrère, 2004; Figueiredo De Oliveira & Peridy, 2015; Ramli & Ismael, 2014). This is why, also based on this model, this section proposes to present the theoretical model on the one hand and the empirical model on the other.

3.1. Determination of the Theoretical Model

This involves presenting the version of the Anderson & Van Wincoop (2003) gravity model and discussing different estimation methods.

Nowadays, the forces of attraction and repulsion in international trade are formalized using the augmented gravity model (Anderson & Wincoop, 2003). This model has a great advantage because it is relatively flexible and allows the introduction of many variables (difference in specialisation structures, difference in levels of development, etc.).

Considering the forces of attraction and repulsion in trade, the equation of Anderson & Van Wincoop (2003) can be written:

$$X_{ij} = \frac{Y_i Y_j}{Y}\left(\frac{T_{ij}}{P_i P_j}\right)^{1-\sigma} \quad (1)$$

X_{ij} is the bilateral trade between i (exporter) and j (importer), Y_i and Y_j respectively represent the size of the economy i and j as measured by GDP, Y represents the size of the world economy (as measured by global GDP) and σ is the elasticity of substitution between traded goods. T_{ij} represents the cost of trade generally designating a common border, the common language, common colonizer, one was a colony of the other at one time, if one of the two is a landlocked country, if the countries are members of a trade agreement; and P_i P_j represents the multilateral trade resistance of countries i and j respectively. Indeed, it reflects the average resistance to trade between a country and all its partners.

Three approaches exist to address the problem of the non-observability of multilateral resistance terms: the use of published price index data (Head & Mayer, 2014), the use of the iterative method (Anderson & van Wincoop, 2003) and finally the use of fixed effects from exporting and importing countries. The latter approach, because of its flexibility, is widely used in the literature (Baldwin, 2006). According to Baldwin & Taglioni (2007), the bias in estimating the gravity model can come from three errors, namely: 1) an error related to the omission of certain potential determinants of bilateral trade ("*Gold Medal Error*"); 2) an error in accounting for bilateral exports as an average of reciprocal flows ("*Silver Medal Error*"); and 3) an error induced by the use of real GDP ("*Bronze Medal Error*"). To correct these errors, we introduce both time-invariant dummy variables and a panel data specification that avoids calculating the average of reciprocal flows, and time dummy variables (Baldwin & Taglioni, 2007).

Estimation process

The econometric estimation of the gravity model is very complex and the estimation methods used have different specificities.

Ordinary Least Squares are (OLS) estimated using cross-sectional data. However, it is important to consider data dynamics, detect effects that cannot be easily observed in cross-sectional data and have less collinearity between variables. However, ordinary fixed-effect least squares present several econometric problems in the gravity model. For example, the presence of even country fixed effects in the model does not allow the effect of time-invariant explanatory variables to be identified, such as distance, language and common boundary.

The other problem that Ordinary Least Squares (OLS) suffer from is the heteroscedasticity of the residues. The presence of heteroskedasticity does not lead to a bias on the estimated coefficients, but it affects the standard deviations of these coefficients and also Student statistics (Freudenberg et al., 1998).

Another estimation technique used to estimate the gravity model is the Tobit estimator (Anderson & Marcouiller, 2002). The Tobit model recognizes the existence of zero values in the dependent variable and processes them by normalizing the error distribution. Under the assumption of zero censorship, the appropriate estimation technique is Tobit. This method quickly finds limits when the variables are transformed into logarithms, some observations becoming undetermined. By censoring the dependent variable to take only positive values, an additional bias is created, which could make the estimators less robust. In response to these econometric problems mentioned above, sophisticated tools (Maximum Pseudo of the Fish Law (PPML); Heckman two-step (2) method) to overcome these problems are increasingly used.

Santos Silva & Tenreyro (2006) suggest solving these problems using Pseudo Maximum Likelihood estimation from a Fish Law (PPML). The PPML estimator has the advantage of being convergent in the presence of heteroscedasticity and of effectively addressing the problem of zero values of the trade variable. Indeed, the specification in logarithm of the export variable leads to the elimination of observations for which trade has a zero value. The Poisson estimator integrates

all observations and thus avoids a potential selection bias. For these reasons, we prefer this method.

Santos-Silva & Tenreyro (2010, 2011) recommend the use of the Pseudo Maximum Likelihood Fish (PPML) estimator, which, in their opinion, is as robust as the Gamma estimator because of the similarity of their first order conditions (Head & Mayer, 2014). Several other contributions relating to different non-linear estimators followed. De Benedictis & Taglioni (2011) point out that when the zero-prevalence rate is high in trade flows, the PPML is no longer appropriate. They propose to use the "Zero-Inflated Fish Model or Zero-Inflated Negative Binominal Model". On the other hand, Head & Mayer (2014) advise against using the negative binomial law (NEGBIN), even if the dependent variable is quite widely dispersed, because of the high sensitivity of this estimator to the unit of measurement of the dependent variable. When the zeros in the sample are not random, another proposed solution is Heckman's (1979) two-step method. This method also allows the selection bias to be corrected. More clearly, Heckman's (1979) estimate allows for the correction of non-random samples. Zero trade flows are therefore the result of a selection procedure.

3.2. Presentation of the Empirical Model

In this article, we adopt the following augmented log-linear form:

$$\begin{aligned}\log X_{ijt} = {} & \alpha_0 + \alpha_1 \log y_{it} + \alpha_2 \log y_{jt} + \alpha_3 \log \text{pop}_{it} + \alpha_4 \log \text{pop}_{jt} \\ & + \alpha_5 \log \text{dist}_{ij} + \alpha_6 \text{lang}_{ij} + \alpha_7 \text{ccol}_{ij} + \alpha_8 \text{ouv}_{ij} \\ & + \alpha_9 \log \text{infrastructures}_{it} + \alpha_{10} \log \text{igouv}_{it} + \lambda_{ij} + \lambda_t + \varepsilon_{ijt}\end{aligned} \tag{2}$$

In this specification, $\log X_{ijt}$ represents the country's bilateral exports i to the country j at period t; $\log y_{it}$ and $\log y_{jt}$ respectively refer to the logarithm of GDP of countries i and j at period t; $\log \text{pop}_{i(j)}$ logarithm of the population of country i and j; ouv_{ij} is the dummy variable for simultaneous opening of partners of 1 if the countries i and j are simultaneously open to the sea and 0 if not; loginfrastructures$_{it}$ is the logarithmic vector of variables including physical infrastructures at period t. These are: paved road kilometer of country i at period t; railway kilometer of country i; air freight of country i; percentage of people using mobile phones and percentage of people using the Internet; igouv_{it} is the average of the governance indicators of Kaufman et al. (2010)[8].

[8]It is about: 1) Voice and Accountability measures the way in which a country's citizens participate in the selection of their leaders, as well as freedom of expression, association and the press; 2) Political Stability and Absence of Violence/Terrorism measures the perception of the likelihood of destabilization or overthrow of Government by unconstitutional or violent means, including terrorism; 3) Government Effectiveness measures the quality of public services, the performance of the public service and its level of independence from political pressures, the quality of policy development and implementation, and the credibility of government commitment to these policies; 4) Regulatory Quality measures the ability of governments to develop and implement sound policies and regulations conducive to the development of the private sector; 5) Rule of Law measures citizens' confidence in and compliance with socially designed rules and, in particular, compliance with contracts, the skills of the police and courts, and the perception of crime and violence; 6) Control of Corruption measures the use of public authorities for personal enrichment, including grand and petty corruption, as well as the "hostage taking" of the state by elites and private interests.

λ_{ij} and λ_t refer respectively to the individual bilateral effects between country i and j and the temporal fixed effects at period t; ε_{ijt} the error term between i and j at period t; α_0 represents the constant; i (i = 1, ..., 6): represents all CEMAC countries and j all major partner countries.

The expected signs of the coefficients of different variables in the model are among others:

- $pop_{(i)j}$ and $Y_{(i)j}$ are of positive sign (+);
- $distwces_{ij}$ is of negative sign (−);
- $lang_{ij}$ and $ccol_{ij}$ are of positive (+) or negative (−) sign;
- $infrastructures_{it}$ variables constituting this vector are negative (−);
- $igouv_{it}$ is of negative sign (−);
- ouv_{ij} is of positive sign (+).

3.3. Data Source and Description of Variables

The data used cover the period from 2006 to 2016 and cover the aggregate flows of the six CEMAC countries to their main partners. These data come from different sources as described in Table 1.

The interpretation of the results is based only on the PPML estimator. The Fish estimator and the Gamma estimator result in consistent estimators, in the presence of zeros and a high dispersion of the dependent variable. We also use the Zero-Inflated Negative Binominal Model (ZINBPML) and the Zero-Inflated Fish Model (ZIPPML) which are also consistent in case of high dispersion of the dependent variable (De Benedictis & Taglioni, 2011).

Table 1. Description of variables and data sources.

Variables	Description	Data sources
X_{ij}	It is the dependent variable that measures the bilateral trade betwen i and j.	WITS (COMTRADE)
$dist_{ij}$	This is the distance that separates country i and j. It's calculated from geographic coordinates and measured in kilometers.	CEPII
$Y_{(i)j}$	Gross Domestic Product (GDP) of country i and j	UNCTAD
$POP_{(i)j}$	Population Total of countries i and j	UNCTAD
$LANG_{ij}$	Dummy variable indicating common language sharing between countries i and j	CEPII
$CCOL_{ij}$	Dummy variable that indicates whether countries i and j have a common colonizer	CEPII
ouv_{ij}	Dummy variable to capture if countries i and j have a maritime opening	CEPII
$igouv_{it}$	This is the simple arithmetic mean of governance indicators	Authors based on World Bank
$infrastructures_{it}$	It's all the physical infrastructure that considered in the model	WDI and UIT

Source: authors' construction.

4. Interpretation of the Results

The results of the econometric estimates and robustness tests are presented in the table below (Table 2).

Table 2. Results of estimation.

VARIABLES	PPML	MCO	GAMMA	NEGBIN
$\log dist_{ij}$	−0.893***	−0.0000697	−0.312**	−0.134
	(0.134)	(0.164)	(0.135)	(0.197)
ouv_{ij}	0.0741***	−2.171***	−2.585***	−2.228***
	(0.350)	(0.402)	(0.337)	(0.411)
$lang_{ij}$	0.215*	1.506***	−0.00613	−0.864***
	(0.325)	(0.345)	(0.0238)	(0.252)
$ccol_{ij}$	0.263	0.792	−0.134***	−1.101
	(0.578)	(0.801)	(0.0500)	(0.755)
$\log y_i$	0.538	−0.915	−0.0628	−1.418**
	(0.695)	(0.828)	(0.0503)	(0.704)
$\log y_j$	0.102**	0.725***	0.0432***	0.0944
	(0.0864)	(0.0822)	(0.00519)	(0.0718)
$\log pop_i$	1.094	0.638	0.0231	0.597***
	(0.728)	(0.858)	(0.0512)	(0.187)
$\log pop_j$	0.845***	−1.626***	−0.112***	1.083***
	(0.0782)	(0.151)	(0.0115)	(0.309)
$\log igouv_i$	−1.278*	0.975	0.0717	−0.804
	(2.117)	(1.980)	(0.108)	(1.485)
lograils	0.12800	−0.000161	−4.15e−05	0.0668
	(0.000489)	(0.000520)	(2.93e−05)	(0.0565)
logfreight	0.2110	−0.00892	−0.000287	−0.000783
	(0.0137)	(0.00935)	(0.000539)	(0.0102)
logmobile	0.0173	−0.00410	5.27e−05	0.00661
	(0.0139)	(0.0157)	(0.000861)	(0.0101)
loginternet	−0.218	0.0862	0.00240	−0.864***
	(0.0806)	(0.0562)	(0.00343)	(0.252)
logroutes	0.2004	−2.653	3.233	−2.746
	(6.422)	(9.996)	(8.116)	(10.00)
Constant	29.50***	24.90**	4.438***	
	(8.826)	(10.31)	(0.637)	
Even effects	YES	NO	NO	NO
Time effect	YES	NO	NO	NO
Observations	720	476	471	476
R-squared	0.160	0.172		

Source: auhtors' calculations.

Distance, understood as an approximation of commercial costs, has a significant and expected sign coefficient. It has a negative and significant effect on exports and therefore trade integration at 10%. Indeed, when the distance is great, the transport costs can be raised and it can affect price (Baldwin & Taglioni, 2007).

Sharing the common language has a positive and significant effect at 1%. Thus, Trotignon's (2009) view that sharing a common language is a proxy for cultural rapprochement that can reduce business transaction costs is confirmed. CEMAC countries also have trading partners for whom they share the same language. Sharing the same colonizer does not influence trade in the area.

Maritime opening has a positive and significant effect at 10%. This result is in line with UNCTAD's (2013) analyses which show that littoralization is a factor that encourages 80% of international trade. The Seaway resulted in 7.7 times ((exp0.0741 − 1) × 100%) exports in the area. Maritime transport is a mode of transport that allows the transport of goods at high tonnage, which is what can be described as the impact of economies of scale on maritime transport (Cullinane & Khanna, 2000). The bulk of CEMAC countries' trade in containerized goods (manufactured, electronic and food products) is by sea. Maritime infrastructures are at the origin of spatial externalities because landlocked countries such as Central Africa and Chad benefit much more from Cameroon's maritime route to trade.

The estimates only reveal that the coefficients associated with the GDP of country *j* are expected signs. Thus, if the GDP of country *j* increases by 1%, there is an increase in imports of 0.102%. Thus, this increase in GDP can reflect demand and therefore the size of the market to which firms want to have access. On the other hand, the GDP of country *i* has no significant effect.

If the population of country *j* increases by 1%, this increases exports by 0.845%. The increase in demographics is a factor that may explain the increase in the number of consumers. If the governance score increases by 1%, exports decrease by 2.728%. This result is similar to the conclusions of Anderson & Marcouiller (2002), which showed that poor governance negatively affects trade and therefore regional integration. Several elements may justify such a conclusion. First, some countries in the subregion are subject to increasing insecurity and instability due to the proliferation of sophisticated weapons, the circulation of terrorist groups and transnational organized crime (Example: Boko Haram). Then, in terms of political stability, in recent years Central Africa Republic has been sinking into a civil war that indirectly affects other countries in the area. Finally, when it comes to corruption, countries such as the Democratic Republic of Congo, Equatorial Guinea, Chad and CAR are among the most corrupt countries in the world. All these elements then increase trade transaction costs and reduce flows in the region, which is an obstacle to trade and therefore regional integration.

5. Conclusion

As part of the major issues on the international economy, this paper aims to

analyse the effects of governance and infrastructure on regional integration in the CEMAC. To achieve this general objective, the increased gravity model based on the PPML method was used with data covering the period 2006 to 2013. Thus, it generally emerges that physical infrastructure (transport and telecommunications) has a positive and insignificant influence on regional integration. On the other hand, the seaway has a positive and significant effect on trade integration. While the sea way does influence CEMAC's trade, the factors that determine a port's efficiency are the quality of the port infrastructure and the structure of the port services market. Better infrastructure facilitates port operations. For this, the CEMAC countries must also encourage public-private partnership (PPP) because it constitutes an interesting mode of financing to meet the challenge of infrastructure in Africa

It reduces the time required to perform these operations and improves the quality of the services provided. To increase the transport service base of CEMAC coastal countries, they must seek to strengthen modern port infrastructure, as coastal development is now a vehicle for global integration. Governance-related institutions do not stimulate trade in the CEMAC region. The results of this paper then highlight the importance for the leaders of this zone at a time when a continental free trade area is being set up to invest in good governance in order to increase the potential benefits resulting from trade and therefore from the integration of the CEMAC zone.

The results obtained for this paper can be related to the nature of the transport infrastructure data that are not complete for the study period under consideration. Future studies may be interested in further considering the effects of infrastructure quality on integration.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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