

## A SURVEY OF THE DETERMINANTS OF INTRA-REGIONAL TRADE WITHIN THE CEMAC BLOC COUNTRIES: EVIDENCE USING THE GENERALIZED GRAVITY MODEL AND THE PPML ESTIMATION TECHNIQUE WITH HIGH DIMENSIONAL FIXED EFFECT

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### ABSTRACT

The extensive understanding of the link between Intra-Regional trade and sustainable development has been a primary analytical economic policy tool, exploited over the years. This study provides an extensive understanding of Intra-Regional trade and sustainable development in the CEMAC bloc countries using a panel data over a period of over 28 years (1994 to 2021 inclusive). Data was collected from the World Development Indicators, International Monetary Fund Directory of Trade, Centre D'études Prospectives et D'Informations Internationales, and the Worldwide Governance Indicators. The ex post facto research design was used. The method adopted in this study is the Poisson Pseudo Maximum Likelihood (PPML) with a High-Dimensional Fixed Effect (HDFE) estimation technique to determine the coefficients of the variables stated in the model. The main finding of this study reveals that intra-regional trade in CEMAC bloc countries is significantly influence positively by sustainable development, economic size, population and when there are dominance in cross-border trade, and proximity effects. Based on the findings, it is therefore recommended that policy makers in CEMAC bloc countries should introduce economic policies and developmental strategies that provide incentives for businesses to engage in sustainable practices as part of their trade operations. Also, policies should be geared towards harnessing population potentials, formalizing cross-border trades, and investing in transport and

industrial infrastructure to enhance proximity effects and deepening intra-regional trade integration.

**KEYWORDS:** *Intra-Regional trade, Sustainable development, General Gravity Model, PPML, HDFE*

## 1. INTRODUCTION

Throughout history, while countries have secured their interests, they have also tried to strengthen trade relations through various arrangements with other countries especially with the CEMAC Bloc countries. This is seen from colonial preferences to bilateral commercial treaties to broader regional agreements. These arrangements have also overlapped and interacted, creating a global trade landscape by clear-cut choices between regionalism and multilateralism among multiple trade regimes which further fosters sustainable development (World Trade Organisation [WTO], 2021). In today's design of the WTO planning, international trade cooperation has generally become broader and more inclusive with more countries in the CEMAC bloc entering into binding agreements, and with more rules being consolidated. World trade has become progressively more open and less discriminatory over recent decades. This act has led to trade policies and trade agreements becoming deeper and wider concerns in reaching the needs of the countries involved and deepening world economic integrations while adding to what is known today as globalisation.

When early economists, such as David Ricardo, explained the concepts of comparative and absolute advantages of trading within countries and also Adam Smith's appreciation and advocacy on division of labour and specialisation, the modern world has become increasingly more concerned with economic integration. It will not be exaggeration to say that trade economists hold that international trade is largely governed mainly by differences in endowments and productivity, especially primarily because there has been an ongoing worldwide reduction in trade barriers. This has led to the vast expansion of international trade and trade agreements with various intricacies. The widespread in trade agreements and their resulting consequences are factors influenced by sustainable development goals and objectives today. Since the advent of the General Agreement on Tariffs and Trade (GATT) in 1947, there have been increasing trends in multilateral trade over the past years, which have led to the encouragement and offshoot of greater border openness and liberalisation. However, there had been an early prototype of GATT known as the Preferential Trade Agreements (PTAs) that existed long before the advent of the multilateral trading system.

As far back as the early 1990s, there had been growing concern about a persuasive link between trade, and sustainable development. This concept has gained a wide range of attention in recent studies (Álvarez et al., 2018 in Abreo et al., 2021). In 1860, Britain and France concluded on one of the most prominent treaties known as the Cobden-Chevalier treaty that David Lazer has described as the priming of a “free trade epidemic” that infected the European continent and led to a “swift break with centuries of protection” (WTO, 2021). The Cobden-Chevalier Treaty established a stronger trade relationship between France and Britain, facilitating the establishment of a network of reciprocal and inclusive trade treaties. Nonetheless, the advent of GATT and the World Trade Organisation (WTO) has not diminished the attractiveness of bilateral and regional approaches to trade. Reasons why we have today the Economic and Monetary Community of Central Africa (Communauté Économique et Monétaire de l’Afrique Centrale, CEMAC), consisting of Cameroon, the Central African Republic (CAR), Chad, Gabon, Equatorial Guinea, and the Republic of the Congo, with the free movement of goods within the region and a common external tariff (CET).

Political liberalisation in many developing countries can lead to economic policies that are detrimental to economic growth and as such, sustainable development. Abeyasinghe (2004) also pointed out that those economic policies that may be beneficial to growth, such as trade liberalisation policies, may not be implemented by countries that have a greater level of political freedom. This can be exemplified by examining the situation of countries such as South Korea, which faced challenges during the late 1980s when its government attempted to move towards not only greater political freedom but also economic freedom. Thus, with democratisation in full swing, Korean interest groups, such as the farmers, agitated against free market policies, such as import liberalisation, preventing the existing government from implementing free market policies (Abeyasinghe, 2004). The uncertainty associated with an unstable growth and development may reduce trade.

Hyden, Court and Mease (2004), viewed that “getting politics right” is a prerequisite condition for trade and development. This view has become increasingly well-established among governments, as well as among international donors and non-state actors globally. This has shown an increase in the focus on the causal effect of a country’s contemporary level of institutional quality on its subsequent growth performance in recent times, as well as trade and investment willingness.

Largely, the determinants of intra-regional trade are complex and multifaceted. When sustainable development is strengthened, for instance, countries tend to promote cooperative

ties that promote trade. Policymakers use this premise in creating a virtuous cycle that drives sustainable development, reduces poverty, and promotes intra-regional trade in their countries.

## 2. Literature Review

The theoretical foundation for this study is drawn from the Gravity Model of International Trade as postulated by Tinbergen (1962) and Poyhonen (1963) as a simple comparison between Newton’s Universal Law of Gravitation and factors that would influence trade flows. The model was therefore formulated based on the Law of Universal Gravity as purported by the English physicist Isaac Newton (Abreo et al., 2021). Jan Tinbergen proposed that the size of trade flows between any two countries can be approximated by employing the ‘gravity equation’, and that countries are attracted to each other in proportion to their sizes and proximity as planets will do (Abreo et al., 2021). In other words, the gravity model of international trade states that, the volume of trade between two countries is proportional to their economic mass and a measure of their relative trade frictions (Baier & Standaert, 2020). This is illustrated as:

$$X_{ij} = C \frac{Y_i Y_j}{t_{ij}} \dots\dots\dots (2.1)$$

(Intuitive gravity for trade equation)

where  $X_{ij}$  = export (trade) from country  $i$  to  $j$ ,  $C$  is constant,  $Y$  = economic mass which is a proxy for GDP.  $t$  is trade cost between two countries and is proxy by distance, adjacency, policy factor. The export (trade) between the two countries will depend on their economic masses (GDP) and negatively related to trade costs (distance) between them.

The model works well with basic perception about the drivers of international trade by explaining some important stylized facts about international trade. The model is intuitively appealing, and also happens to have very strong explanatory power with issues patterning to trade (Prabir, 2012). Other authors such as Baier et al. (2014), Kabir et al. (2017) have extended the original gravity model of Tinbergen (1962) by adding other variables that might significantly affect trade apart from its traditional GDP and the distance between trading partners.

Oloyede and Lawal (2025) investigated the impact of Regional Trade Agreements (RTAs) on intra-African trade by employing an augmented gravity model. A panel dataset was obtained for 36 African countries from 2008 to 2023. They employed the Pseudo-Poisson Maximum Likelihood (PPML) estimator. The findings revealed that RTAs significantly enhance trade

flows within the continent. The study further revealed that economic size, geographical contiguity, and a shared official language exerted a positive, statistically significant influence on trade. Based on the findings, the study recommends reinforcing implementation of the African Continental Free Trade Area (AfCFTA) through regulatory harmonisation and the systematic elimination of non-tariff barriers to unlock its full trade potential and foster deeper regional integration.

Mpejane and Ndebele (2023) examined the impact of institutional quality and institutional quality distance on intra-Southern African Development Community (SADC) agricultural trade using the gravity model of trade from 1991 to 2010. They adopted the two-step Heckman (1979) sample selection model. The results demonstrate that institutions determine the volume of agricultural trade between SADC member states, that these impacts differ depending on the type of institution, and that strong economic institutions have a significant negative impact on intra-SADC agricultural trade.

Oshota et al. (2022) investigated institutional quality and intra-regional trade flows in the ECOWAS regional bloc from 2000-2018. While employing the negative binomial pseudo-maximum likelihood estimator (NBPML) with the use of the gravity model, they found out that institutional variables with both aggregated and disaggregated measures of the quality of institutions have a significant and positive impact on intra-ECOWAS trade flows. They concluded that the degree of regional integration is an important determinant of intra-ECOWAS trade, along with GDP, GDP per capita, a common language, and landlockedness.

Ferreira, Steenkamp and Rossouw (2022) conducted a study targeting the untapped intra-regional trade opportunities for trade integration in Africa by translating the potential trade values of the identified untapped intra-regional trade opportunities between African countries into Global Trade Analysis Project (GTAP) model shocks. Using GTAP general equilibrium simulations, the study finds that in addition to the removal of tariffs, targeted increases in trade efficiency phased in over time produce much higher economic gains than a once-off trade efficiency shock. Their findings also revealed that smart trade policies and targeted integration can enhance shared prosperity, not just benefit larger economies alone. This therefore supports sustainable economic integration that can contribute to inclusive growth (SDG 8) and reduce poverty (SDG 1).

Zongo and Oyelami (2021) conducted a study on the impact of institutional quality on intra-African Trade from 1996 to 2019. The study focused on governance quality on intra-African trade in primary and manufactured goods in 48 sub-Saharan African Countries. Using the

PPML and a gravity model, the analysis of the disaggregated indices shows positive and significant effects of all six indices on exports of manufactured and primary goods. The study recommended that, for Africa to establish a promising African continental free trade area (AfCFTA), sub-Saharan African countries need to devise a strong institutional framework to facilitate transparency and security, thereby boosting intra-African trade.

Abban (2020) conducted a study on the Economic Community of West African States (ECOWAS) using the PPML estimator for the augmented gravity model of international trade. The findings show that institutional quality, as measured by political stability and the role of law, facilitated intra-regional trade in the ECOWAS, while institutional quality, as measured by regulatory quality, corruption control, and government effectiveness, hindered trade. The study recommends a new institutional framework to address the problems that hinder intra-regional trade and emphasises the need to intensify security as a paramount requirement to facilitate intra-regional trade in the ECOWAS bloc.

Ogbuabor et al. (2019) examined the impact of intra-regional trade on economic growth in the West African Economic and Monetary Union (WAEMU) bloc from 2000 to 2015 using the Instrumental Variable System GMM regression within a cross-country growth model. Their findings indicated that foreign direct investment (FDI), institutional quality, capital, labour, and initial real per capita GDP have a positive and significant impact on economic growth in the WAEMU region. Based on the findings, the study recommends that policy reforms to improve institutions be undertaken and that measures aimed at attracting foreign direct investment be encouraged, as this will go a long way to spur economic growth in the WAEMU bloc.

Nguenkwe and Tchitchoua (2019) examined the impact of trade facilitation measures on intra-regional trade between ECCAS and ECOWAS while focusing on the role of Information and Communication Technology and customs environment indicators. They employed the PPML as proposed by Santos Silva & Tenreyro. Using the augmented gravity model, the results revealed that the internet has a positive and significant impact on intra-ECCAS trade but no impact on intra-ECOWAS trade. The results also showed that the number of days for export has a negative and significant impact on intra-regional trade in both zones, while the result of the number of documents is ambiguous. They recommended that, to reach the intra-ECOWAS trade level, ECCAS countries will have to concentrate on a trade development strategy to diversify their economies and be complementary, thereby minimising trade diversion.

Saputra (2019) looked at the impact of corruption on trade flows in both developed and developing countries. Using panel data for over 22 years (from 1995 to 2016 inclusive) and employing the gravity model, Saputra examined 19 industrialised nations and 11 developing countries, with the parameters ranging from national income, distance, foreign direct investment, competitiveness, export, import, and corruption. The study reveals that low levels of internal corruption have a positive influence on Intra-Regional trade. Furthermore, a low degree of corruption in developing nations has a more significant positive effect on trade compared to developed countries.

Yushi et al. (2019) investigated the impacts of institutional quality and infrastructure on overall and intra-African trade, covering 44 African countries and their 173 trade partners for the period 2000–2014. They used trade inflows from African countries to their trade partners. They employed the gravity model and the PPML estimation technique by Santos Silva and Tenreyro (2006). Their findings revealed that intra-Africa and overall Africa's trade are robustly determined by the quality of institutions, border and transport efficiency, and physical and communication infrastructure. They recommended significantly improving the quality of domestic institutions in African countries, physical and communication infrastructure, and border and transport efficiency, so as to help reduce the cost of trade in African countries and to facilitate their trade performance.

Ngepah and Udeagha (2018) examined the impact of regional trade agreements on intra-regional trade in the CEMAC, Southern African Development Community (SADC), South African Customs Union (SACU), West African Economic and Monetary Union (WAEMU) and the East African Community (EAC). Using the gravity model of international trade and the PPML method of estimation, the study revealed that intra-regional trade increased significantly in CEMAC, SADC, SACU, and WAEMU. In contrast, it declined over time in the EAC. Based on the findings, the study recommends rapid progress in removing tariff and non-tariff barriers to boost intra-regional trade.

Ouma (2017) investigated the causes of intra-regional agricultural export trade in the East African Community (EAC) from 2000 to 2012 across the 05 EAC member countries. The study developed five augmented gravity models, which were estimated using the PPML method. Based on the findings, the study revealed that intra-EAC agricultural exports largely depend on the exporter's GDP, the importer's GDP, the exchange rate, the distance between the economic centres, language similarities, adjacency, and the exporter's population. The study also showed that Distance had a significant but negative impact on intra-EAC

agricultural exports. The study recommended that EAC member States enhance border liberalisation to encourage intra-regional agricultural trade.

### 3. Methodological Issues

This study is carried out in the Economic and Monetary Community of Central Africa (Communauté Économique et Monétaire de l’Afrique Centrale, CEMAC. CEMAC took over from the Central African Customs and Economic Union (UDEAC) created in 1964 with the main goal of promoting economic integration and cooperation among member states.

The secondary data used for this study covers the period from 1994 to 2021. These include data on GDP per capita, Sustainable Development, and Population, which measure the economic perspectives retrieved from World Development Indicators (WDI). Also, data on Common Borders, which is a dummy, was also extracted from WDI. Again, data on trade are extracted from the Directory of Trade (DOT) of the International Monetary Fund (IMF). The geographical variable (Distance) is obtained from Centre D’études Prospectives et d’Informations Internationales. In addition, the Institutional Quality variables (voice and accountability, rule of law, corruption, regulatory quality, political stability, and government effectiveness) data are obtained from the Worldwide Governance Indicators (WGI).

Following the theoretical foundations of Tinbergen’s gravity model (1962), the model for this study is specified in its estimable panel form as follows:

$$IRT_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 SD_{it} + \beta_4 SD_{jt} + \beta_5 IQ_{it} + \beta_6 IQ_{jt} + \beta_7 \ln POP_{it} + \beta_8 \ln POP_{jt} + \beta_9 CB_{ijt} + \beta_{10} \ln DIST_{ijt} + \mu_{ijt} \dots\dots\dots (3.1)$$

A priori expectations are that  $\beta_0 \neq 0$ ;  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$  and  $\beta_9 > 0$  and  $\beta_{10} < 0$

Where  $IRT_{ijt}$  is intra-regional trade flow from country  $i$  (exporting) to country  $j$  (importing) in time  $t$ ;  $GDP_i$  and  $GDP_j$  are values of real gross domestic product;  $SD_i$  and  $SD_j$  are values of sustainable development in the exporting  $i$  and the importing countries  $j$  respectively;  $IQ_i$  and  $IQ_j$  are represent institutional quality of both countries  $i$  and  $j$ ;  $POP_i$  and  $POP_j$  are the sizes of their population;  $CB_{ij}$  is a dummy variable that takes the value 1 if country  $i$  and  $j$  share a common border and zero if otherwise.  $\beta_0$  is the constant term;  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9$  and  $\beta_{10}$  represent the elasticities of output relative to the variables under consideration.  $\mu_{ij}$  represents the stochastic elements that affect intra-regional trade and influence its outcomes, but were not captured in the models. It is a normally distributed random error term with  $\mu_{ij} = 0$ .  $\ln$  is a logarithmic transformation on non-negative and non-ratio variables in the model. The variables were logged to linearise them, to make skewed variables linear, and to

normalise skewed variables. *SD*, and *IQ* were not logged since there are indices and *CB* was not logged because it is a dummy variable.

The estimation technique adopted in this study is the Poisson Pseudo Maximum Likelihood (PPML) estimation technique due to the fact that heteroscedasticity will not result in biased estimates and the PPML gives appropriate justification for the pattern of heteroscedasticity characteristics in trade data when using PPML (Santos and Tenreyro, 2011). Secondly, zero-trade observations can be included in the model (Wooldridge, 2010) and for the fact that PPML is less sensitive than Generalised Method of Moments (GMM) to the specification of the error distribution and can also handle a broader range of variance structures (Greene, 2018).

This study conducted a cross-sectional dependence (CD) test. The cross-sectional dependence test used in this study is one of the most commonly known cross-sectional dependence test called Pesaran's cross-sectional dependence test. The Pesaran CD-test employs the correlation coefficients between the time series for each panel member. The CD statistic is expressed mathematically as:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij}$$

This summarises the empirical correlation coefficients among residuals from  $N$  separate OLS regressions per individual  $i$ . Under the null hypothesis of cross-sectional independence, CD is distributed as  $N(0,1)$ . One may want to apply the second generational text when the tested hypothesis is rejected under CD.

For this study, the Pesaran CD test is employed to test for Cross-sectional dependence in the models. This is based on a scaled average of the pairwise correlation coefficients for each individual's residuals. The CD Test assumes that the residuals from a panel data model are cross-sectionally independent. By implication, the errors for each individual unit are not correlated with the errors of other units at the same point in time. Summarily, the CD test is based on the null hypothesis that the Residuals are cross-sectionally independent while the alternative hypothesis holds that the residuals are cross-sectionally dependent. This means there is a correlation.

4. Presentation and Discussion of Findings

4.1 Presentation and Discussion of the Pesaran Cross-Sectional Independence Test

Table 4.1: Pesaran Cross-Sectional Independence Test Results.

Variable	CD-test	p-value	average joint T
Intra-regional trade	0	1.000	13.00
Home country sustainable development	.	.	.
Foreign country sustainable development	.	.	.
Home country institutional quality	1.164	0.244	13.00
Foreign country institutional quality	1.164	0.244	13.00
Home country GDP	0.643	0.520	13.00
Foreign country GDP	0.643	0.520	13.00
Home country INF	1.181	0.238	13.00
Foreign country INF	1.181	0.238	13.00
Home country Population	0.599	0.549	13.00
Foreign country population	0.599	0.549	13.00
Distance	1.142	0.224	13.00
Common borders	0	1.000	13.00

Source: Computed by Author using Stata (2026)

The results in Table 4.1 above are from the Pesaran Cross-Sectional Independence test. The results show that all p-values are greater than 5%, so we fail to reject the null hypotheses and conclude that there is no evidence of cross-sectional dependence in the models. In other words, there is no strong evidence that shocks in one country are correlated with shocks in others.

Based on the above test results, it was therefore not necessary to further integrate other robust tests to correct for cross-sectional dependence, such as Pesaran’s Common Correlated Effects estimators or the Driscoll-Kraay standard errors test. These techniques will enable cross-sectional averages of the dependent and independent variables to absorb common shocks, leading to robust and consistent estimates.

4.3 Presentation and Discussion of the PPML Regression Results

Table 4.2: PPML Regression Results for the Determinants of Intra-Regional Trade.

Variables	Intra-regional trade
Home country sustainable development	0.00075* (0.00043)
Foreign country sustainable development	0.00126*** (0.00026)
Home country GDP	0.04485*** (0.0096)

Foreign country GDP	0.0354***
	(0.0083)
Home country institutional quality	0.0086
	(0.0096)
Foreign country institutional quality	0
	(0)
Home country population	0.0029
	(0.0083)
Foreign country population	0.0143**
	(0.0070)
Distance	-0.0000
	(0.0000)
Common borders	0.1248***
	(0.0161)
Constant	0.5281***
	(0.1439)
Observations	654

Source: Author Computation using Stata 17

The results of the PPML regression presented in Table 4.2 above indicate that sustainable development for both home and foreign countries has a positive and statistically significant effect on intra-regional trade in CEMAC. It shows that a unit change in sustainable development of the home country will lead to a 0.042% change in intra-regional trade, and a unit change in the foreign country’s sustainable development will lead to a 0.026% change in intra-regional trade in the same direction. The positive and significant effect of sustainable development on Intra-Regional trade is buttressed by Kaim (2021), which hold that the growing public sentiment against free trade agreements cannot be looked at without an increase in the number of sustainability-related precepts. This had also been supported by Bernauer and Nguyen (2015), who hold that Preferential Trade Agreements (PTAs) are imperative if such trade agreements were to gather the necessary public and legislative support to enter into force. It is therefore imperative for policy makers in the CEMAC bloc to become more forceful in using issues of higher environmental and other sustainability-related standards as an integral part of diplomatic strategy and practice in order to improve on Intra-Regional trade.

The results of the PPML regression presented in Table 4.2 above indicate that both the GDP of home and foreign countries has a positive and significant impact on intra-regional trade within the CEMAC bloc. A unit increase in the GDP of the home country will increase CEMAC Intra-Regional trade by 4.49% while for foreign country will lead to a 3.54% increase in intra-regional trade in the CEMAC bloc. This outcome conforms to the prediction

of Tinbergen (1962) and Poyhonen (1963) on factors that would influence Intra-Regional trade flows as postulated in the gravity model. The model predicts a direct relationship between trade flows and the GDP of the exporting country as well as the GDP of the importing country. The outcome of findings is also in conformity with findings of authors such as Sunde (2009), Mulenga (2012), Salisu et al. (2013), Abdullah et al. (2014), Yabu (2014), Dada and Adeleke (2015), Sebbagh et al. (2015), Ouma (2017), Oloba and Akinbobola (2017), Muryani and Pratiwi (2018), Hossain (2018), and Oparanya (2019). From the above, it is therefore important for policymakers in the CEMAC bloc to mobilise resources geared towards enhancing product and investment capacities, aiming to increase the GDP of their member states and boost intra-regional trade flows.

In addition, the results in Table 4.2 show that institutional quality, both at home and abroad, positively affects intra-regional trade in CEMAC countries. However, this outcome is statistically insignificant. Although the results are statistically insignificant, the positive outcomes align with the work of Choramo et al. (2024), Oshota et al. (2022), and Zongo and Oyelami (2021), which show that institutional quality influences a country's position in the African trade network. Dollar and Kraay (2003), Bojnec et al. (2009), Matthew (2017), and Beverelli et al. (2018), who hold that the primary source of high intra-regional trade flows and high development is usually attributed to the quality of domestic institutions. It also falls in line with Tadesse et al. (2019). To them, an economically robust and sustainable reduction in Intra-Regional trade costs facing developing countries requires the presence of both promulgated and effectively functioning institutions, such as regulatory power and the rule of law. However, this outcome is in contrary with Thu (2021), who holds that the institutional quality of Myanmar during the military rule (2000-2010) has statistically significant negative effects on Intra-Regional trade.

The PPML results in Table 4.2 also revealed that both home and foreign countries' populations have a positive effect on intra-regional trade in the CEMAC bloc. This means that a unit increase in home-country and foreign-country populations will lead to 0.29% and 1.43% increases in intra-regional trade in the CEMAC bloc, respectively. However, the population of the home country is not statistically significant, whereas that of the foreign country is at the 5% level. This aligns with the study by Fatima, Nisar, and Yasmin (2019), which asserts that populations have a significant and positive impact on intra-regional trade. However, this effect of population on intra-regional trade are in contrast with the findings of Fohoue, Xin and Momoh (2024), who hold that there exists a negative correlation between population growth and trade dynamics. Specifically, an increase in population will reduce

exports by boosting local demand for goods and services, while at the same time reducing imports due to weakened economic conditions and diminished purchasing power.

Again, it is observed that distance has a negative and insignificant impact on intra-regional trade in CEMAC countries. A unit increase in distance will lead to a dismal 0.000% decrease in intra-regional trade in the CEMAC bloc. This outcome is also in line with Tinbergen's (1962) gravity model, which holds that trade flows between the two countries will depend on their economic masses (GDP) and are negatively related to trade costs (distance) between them. The findings are also in conformity with some authors such as Muryani and Pratiwi (2008), Sunde (2009), Hossain (2018), Kagochi and Durmaz (2018), , Oloba and Akinbobola (2017), Ouma (2017), Mohammad (2018), Dada and Adeleke (2015), Sebbagh et al. (2015), Abdullah et al. (2014), Salisu et al. (2013), Mulenga (2012), Ntembe and Tawah (2012), and Musanda (1997). As a matter of policy, it is advisable for policy makers in CEMAC bloc should understand that distance between member countries are a hindrance to Intra-Regional trade and as such, policies should be geared towards increase in state infrastructures such as road, railways, airways, amongst others, which could serve as a stimulant to efficient and rapid movement of goods, services and persons within the CEMAC bloc. This will go a long way to minimise obstacles emanating from the distance between member countries, thereby boosting Intra-Regional trade in CEMAC.

Furthermore, the PPML regression results in Table 4.2 also revealed that the common border has a positive and significant impact on CEMAC countries. Precisely, when CEMAC member States share a common border, intra-regional trade will increase by 12.48%. The results conform with the findings of Zannou (2009), Mulenga (2012), Ouma (2017), and Kagochi and Durmaz (2018). In this light, therefore, policy makers of the CEMAC bloc should encourage Intra-Regional trade policies such as free trade agreements amongst member countries that share a common border. Other policy measures could be to improve infrastructural and road network connectivity with countries sharing the same border.

This study concludes that, investing in sustainable development practices and other determinants of intra-regional trade such as GDP, and institutional quality frameworks enable countries to leverage intra-regional trade. Sharing the same border within the CEMAC bloc countries foster a conducive environment for effective intra-regional trade. Again, population increases intra-regional as larger partner markets create stronger demand of goods, and services. Also, public infrastructures such as road, railways, airways, amongst others, hampers on Intra-Regional trade as it severely increases trade cost within the CEMAC bloc countries.

## 5. Policy Recommendations

Based on the outcomes of our findings that aimed at investigating the determinants of intra-regional trade within the CEMAC bloc countries, the following policy recommendations could be made:

**Promoting Trade Agreements with Sustainability Focus:** Future trade agreements should incorporate clauses that prioritise environmental protection and social equity. This is because, as noted earlier, trade agreements have varying impacts on institutional quality. Thus, strategic agreements emphasising sustainability can help bridge the gap between trade and development goals.

**Incentivising Sustainable Practices in Trade:** Introduce policies that provide incentives for businesses to engage in sustainable practices as part of their trade operations, such as tax breaks or grants for green technologies. Encouraging businesses to adopt sustainable practices can lead to a more favourable institutional environment and help achieve sustainable development goals.

**Strengthening governance structure:** Effective governance is fundamental to achieving sustainable development as it maximises the benefits of intra-regional trade within CEMAC. Many CEMAC member states face persistent governance challenges including weak regulatory frameworks, limited transparency, bureaucratic inefficiencies, corruption and political instabilities. These institutional weaknesses often undermine the implementation of regional trade agreements and development policies. Strengthening the governance structure should therefore be a priority for both the national government and regional structures such as the Bank of Central Africa, with policy reforms focusing on improving public accountability, strengthening anti-corruption practices, and enhancing regulatory quality in trade-related sectors.

Trade liberalisation alone is insufficient in the CEMAC bloc to translate into sustainable development outcomes. It is therefore necessary for the governments of CEMAC member states to invest in regional transport corridors, energy infrastructure, and digital connectivity in order to reduce transaction costs and improve trade efficiency among member states. Also, targeted support to small and medium-sized enterprises could help expand the region's productivity base and, as such, increase local firms' participation in intra-regional trade. This will ensure that trade integration contributes more to sustainable development.

**Harmonisation across member states:** Institutional harmonisation is essential in improving sustainable development, as differences in regulatory frameworks, administrative procedures, tax policies, and governance standards often create inconsistencies that will hinder the

smooth functioning of regional trade. Institutional harmonisation across member state will also reduce policy fragmentation and improve regional economic coordination. Harmonisation of trade regulation, custom procedures and other investment policies can also significantly reduce administrative barriers and as such, facilitate the movement of goods and services across member states. CEMAC member states can also adopt a standardised business regulation, environmental protection norms, labour policies and a common standard for economic and judiciary policy on trade. Such harmonisation will definitely enhance policy coherence, reduce regulatory uncertainties for investors, and promote a more integrated regional market capable of supporting sustainable development.

Urban planning and population check should be prioritised: Rapid population growth and accelerated urbanisation is a major challenge hindering sustainable development practices in CEMAC bloc countries as they exert excessive pressures on infrastructure, housing, transportation system and environmental resources. CEMAC member states should therefore prioritise sustainable urban planning policies that integrate infrastructural development, land-use management and environmental consideration in order to curb pressure on economic productivity and social welfare.

Promoting and improving cross-border cooperation: strengthening cross-border cooperation will improve the management of share resources and facilitate trade flow through stronger trade relationship due to lower transportation cost, cultural proximity, and the established commercial networking. This common border effect can significantly enhance economic integration and regional development.

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