Влияние региональной интеграции на торговлю сельскохозяйственной продукцией в ЭКОВАС

Н'Горан Коффи Селестен

кандидат экономических наук, старший преподаватель
Университета Пелефоро Гон Кулибали в Корого, Кот-д'Ивуар
E-mail: nkoffiagos2012@gmail.com

Титова Людмила Анатольевна

кандидат экономических наук, доцент
Ярославский государственный университет имени П.Г. Демидова, г. Ярославль, Российская Федерация
E-mail: luxe22@yandex.ru

КЛЮЧЕВЫЕ СЛОВА

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АННОТАЦИЯ

Сельскохозяйственный сектор ЭКОВАС сталкивается с низкими объемами обмена по сравнению с другими регионами. Развитие сельскохозяйственного производства и торговли имеет решающее значение для обеспечения продовольственной безопасности, что является приоритетом для стран-членов. Целенаправленные и укрепляющие производственные системы способствуют развитию торговли внутри сообщества и интеграции региональных рынков. Однако разнообразный сельскохозяйственный потенциал ЭКОВАС сдерживается фрагментацией и различиями в национальных интересах, что делает интеграцию жизненно важной для развития внутрирегиональной торговли. Мы намерены выявить последствия и факторы, влияющие на потоки сельскохозяйственных товаров. Целью данного исследования является анализ влияния региональной интеграции на торговлю сельскохозяйственным сырьем в пятнадцати странах ЭКОВАС за период 2015-2020 гг. Этот вопрос рассматривался с использованием гравитационной модели. Методологический подход, по сути, основан на нескольких моделях. Для анализа технических характеристик моделей были использованы тесты Сяо, Хаусмана и гетероскедастичности. Пуассоновская оценка псевдомаксимального правдоподобия этой модели указывает на то, что уровень развития стран через богатство, качество инфраструктуры и уровень региональной интеграции оказывают влияние на торговлю, но с разными эффектами. Сочетание сельскохозяйственной политики (ECOWAP/PDDAA) не достигло своих целей и не оказывает влияния на торговлю. Более того, единый внешний тариф оказывает различное влияние в зависимости от выбранного показателя торговли. Всестороннее внедрение единого внешнего тарифа во всех странах ЭКОВАС необходимо для расширения двусторонней торговли. Сельскохозяйственная политика должна координироваться и систематически контролироваться для повышения производительности, продовольственной безопасности и уровня жизни в сельской местности. Таким образом, интеграция торговли сельскохозяйственной продукцией в рамках ЭКОВАС демонстрирует значительный потенциал.

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Introduction

The problem of developing the agricultural sector in the Economic Community of West African States (ECOWAS) is still a topical one. The volume of trade in agricultural products between ECOWAS countries

remains very low compared with other integration areas. The exchange of agricultural products between the community could be a powerful tool for strengthening and deepening economic integration. Regional trade integration improves economic activities. production and specialization, and reduces unemployment and food insecurity The agricultural sector plays an extremely important role in the economic and social development process in ECOWAS countries. In these countries, more than half (around 55%) of the workforce is employed in the agricultural sector, which creates national wealth. It generates around 30% of gross domestic product (GDP) and contributes to economic growth. Given that one of the priorities of any nation is food security through the development of production and trade, studies of cross-border dynamics have highlighted the existence of regional trade strategies [1]. This policy has three main objectives: to strengthen production systems, to develop intra- community trade and to integrate regional markets.

It would appear to be essential to examine the causes of the trade malfunction in agricultural products and to adopt a coherent and global approach to the issues related to agricultural products. The regional environment is considered to be the most appropriate place in which to develop a strategy for the agricultural sector. The ECOWAS states have been engaged for several years in a regional process to establish a common agricultural policy.

The agro-ecological diversity and fragmented character of ECOWAS make it a highly diversified agricultural region with considerable potential, but with a number of constraints. The cohabitation of many different interests between countries does not facilitate the emergence of a common vision. The integration of agriculture should make it possible to resolve this problem and intensify intra-regional trade.

The aim of this study is to analyse the effects of regional integration on trade in agricultural products within ECOWAS. One of the most important elements of modern trade systems are commercial agreements, which can be regional, continental or global. This is where the trade integration of ECOWAS agricultural products comes in.

The contribution of regional integration to trade in agricultural exports from ECOWAS was analysed by Wumi and Oluyomi [26]. Using the Within estimator and the GMM panel method, they showed that trade integration is dominated by agricultural exports between member countries.

The study conducted in the West African Economic and Monetary Union (WAEMU) and Central African Economic and Monetary Community (CEMAC) zones for the period 1996-2006 showed the integration effect on trade through a gravity model. Using the pseudo-maximum likelihood poison model (PPML), it showed that the benefits of the union in terms of trade are not equitably distributed between member countries due to the fact that some members of the union have not diversified their economies [6, 3]. African countries need to develop their industrial sector in order to export more high value-added manufactured products.

The structural gravity model will make it possible to measure more fully the impact of the integration of agriculture in ECOWAS, and more specifically the flow of intra-member country trade, by taking into account multilateral resistance, both observable and unobservable. The understanding of the realities of the West African region is essential if we intend to develop an integration model that meets the challenges it faces.

Agriculture, driving forces for integration and a victim of regional fragmentation. It is one of the region's main assets. It is based on extremely diverse agro-ecological zones. These zones range from rainfall gradients of less than 400 mm in the north to rainfall gradients of more than 3,000 mm per year in some parts of the Gulf of Guinea. This allows for a very wide range of crops and cropping systems. Given the high mobility of populations and past and recent migrations within the region, the circulation of West African agricultural products has allowed a diversified food supply to be provided. This diversified nutrition includes a variety of cereals and tubers, as well as a variety of protein sources depending on the availability of meat, milk or fish. The integration of agricultural and food markets is therefore one of the main drivers of trade, given its vitality for economic operators in the region. As well as the size of their economies, West African countries are also fragmented in many ways. This complicates the processes of regionalization and integration of sectoral policies and markets.

The West African region hosts more than nine different currencies. Eight countries are members of the

Franc zone and are united within the West African Economic and Monetary Union (WAEMU). Within this zone, they are committed to an integration strategy based on the creation of a common internal market, with a customs union (Common External Tariff) and the gradual convergence of economic, fiscal and budgetary policies.

All the other countries have their own currency. A second monetary zone project bringing together ECOWAS countries outside the CFA currency from 2004 onwards has not really been implemented. In the near future, the zone will merge with the CFA zone to create the «West African Monetary Zone» (WAMZ).

Commercial fragmentation is a key issue for the agricultural sector. The WAEMU member states have a customs union (in force since January 1st 2000), which means that they apply common external customs duties at the external borders of the WAEMU zone. The trade policy includes a common nomenclature and distinguishes four categories of products to which the increased tariffs are applied. Within the zone, products must meet the principle of free trade, without tariffs or quantity restrictions. Most agricultural products are considered to fall into categories 2 and 3, and are therefore subjected to a community tariff based on the respective 10 or 20% categories [7]. The implementation of this customs union is not yet fully complete, and some countries are worried about its impact, in terms of both competition with their own agricultural production sectors and the reduction in customs revenues, which are regarded as a significant element in national budgets.

There are still obstacles within the internal market. This is particularly pertinent because of all the informal barriers to trade associated with illegal arrests by police and customs authorities. There are also occasional border closures and controls related to security issues and arms flows from conflict zones. The landlocked countries, all members of the WAEMU, benefit from a certain natural protection inherent in their location, making it easier for their local products to protect themselves on the national market than coastal products. On the other hand, when exporting to coastal countries (e.g. rice in Mali, livestock products, horticultural products such as tomatoes, onions, etc. in Niger, Mali and Burkina Faso), transport costs and informal trade barriers are factors that considerably reduce the competitiveness of regional production compared to imported products for export.

Contrary to what the liberalization of trade might lead us to believe, borders are still significant: at comparable sizes and distances, two regions trade less when a border separates them. Assessing border effects, with reference to the trade standard provided by the gravity model, makes it possible to measure the degree of integration or fragmentation of a geographical area, or even to measure the discrimination that may exist between different sources of supply [15]. How is it possible to explain the high level of border effects within an integrated zone? Currency volatility provides part of the answer. Consumer preferences and the existence of particularly dense social or professional networks within borders also explain this phenomenon. However, long-term data suggests a downward trend in border effects, which could be further accentuated by new information technologies.

Inter-ECOWAS agri-food trade takes place between or within member cities through specific trade routes/corridors that cross different borders and are formally established by the trading countries. However, agri-food trade also occurs along informal trade corridors due to the porous nature of land borders and the influence of the culture and traditions of border communities in trading countries.

Methods

The application of the gravity model to international trade goes back to the work of Tinbergen [21] who showed that the size of the importing and exporting country (measured by GDP) is a determining factor in the standard evolution of trade between two countries as well as the geographical distance between these two countries, and refers to the studies of Pöyhönen [19]. A simplified version of this model is presented as follows:

$$c_{ij} = G\frac{M_i M_j}{D_{ij}} \quad (1)$$

Where c_{ij} is the value of exports from country i to country j, M_i and M_j are the national income of country

i and country j, with D_{ij} the distance between the two countries and G is the constant of proportionality. A number of studies employing gravity modelling techniques have been carried out on international business opportunities. Linnemann added new commodity flow explanatory variables to the gravity model to increase the descriptive power of the model [12]. Indeed, his model has had great empirical success. The factors that explain the flow of goods in this model are: the export supply of country i, the import demand of country j and the resistance coefficient. The model is constructed by replacing these factors with the variables that determine them, namely: national income, geographical distance, population and the existence of a preferential trade agreement.

The study covers the fifteen ECOWAS countries, namely Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The study was conducted over the period from 2005 to 2020 due to the availability of statistical reports. The data used comes from several databases. Real GDP in US dollars, population, arable land and official bilateral exchange rates were obtained from the World Bank's WDI database. Data on the road infrastructure are extracted from the INS database (AIDI). Data on bilateral trade in agricultural products (imports and exports) come from WITS, the UNCOMTRADE database. Other data related to the gravity model come from the Center for Prospects and Information International (CEPII).

The gravity model describes global and sectoral bilateral trade flows using forces of attraction such as the distance between the partners and their economic scale. The model can also be used to identify countries and sectors for which there are potential trade gains, and to simulate the impact of an import duty shock on trade flows. Such a model is fairly common in the analysis of the determinants of international trade, and helps to describe the relationship between bilateral trade flows and pull variables such as the distance and size of the partners' economies. Nevertheless, the existence of common borders, former colonial links or a free trade agreement between states all contribute to the intensification of trade. The gravity model is estimated at an aggregate level (based on global annual bilateral trade flows between 15 countries over a 15-year period. The estimation is based on the panel gravity model with zero trade flows and multilateral terms.

The model can then be used to identify countries and sectors with potential trade gains. It therefore serves as a tool to help better target foreign trade support policies at the agricultural level in ECOWAS, and finally to simulate the impact of a tariff shock on trade flows.

The gravity model assumes a «normal» level of bilateral trade and, as a result, the introduction of dummy variables relating to membership of an economic grouping or a monetary zone makes it possible to capture the «atypical» levels of trade resulting from regional integration. In its simplest form, the gravitational equation for any pair of countries (i, j) is as follows:

$$\mathrm{COM}_{ij} = \alpha_0 \frac{(Y_i Y_j)^{\alpha_1}}{(D_{ij})^{\alpha_2}} \tag{2}$$

Where COM_{ij} represents the value of bilateral trade between country i and country j,
Y is the Gross Domestic Product (GDP),
Dij is the distance separating the trading partners.
β_0, β_1 and β_2 are coefficients.
The log-linear form is :

$$\ln \ln \mathrm{COM}_{IJT} = \ln \ln(\alpha_0) + \alpha_1 \ln \ln(Y_{it} Y_{jt}) - \alpha_4 \ln \ln(\mathrm{Dist}_{ij}) \tag{3}$$

The authors suggest that specific variables are generally added, depending on the objectives pursued and theoretical sensitivities. They are quantitative (population, arable land, GDP per capita etc.) and/or qualitative (sociological and historical context, geographical location, integration variables etc.). We refer to Rose [20] for the specification of the extended log-linear form and also introduce control and indicator variables to address the research question of capturing different aspects of the integration of agriculture on West African trade. With the specification of an extended log-linear form to answer our research question, we also introduced control and indicator variables to our basic model [23]. Thus, the extended gravity model looks like this:

$$\begin{aligned}
&\ln \ln \mathrm{COM}_{IJT} = \beta_0 + \beta_1 \ln \ln (Y_{it} Y_{jt}) + \beta_2 \ln \ln (\mathrm{POP}_{it} \mathrm{POP}_{jt}) \\
&+\beta_3 \ln \ln (\mathrm{Terre}_{it} \mathrm{Terre}_{jt}) + \beta_4 \ln \ln (\mathrm{Dist}_{ij}) + \beta_5 \ln \ln (\mathrm{Infrat}_{it}) \\
&+\beta_6 \ln \ln \left(\mathrm{Infrat}_{jt}\right) + \beta_7 \ln \ln \left(\mathrm{Tcr}_{ijt}\right) + \beta_8 \mathrm{Proxy}_{ijt} \\
&+\beta_9 \mathrm{Front}_{ij} + \beta_{10} \mathrm{ComCol}_{ij} + \beta_{11} \mathrm{Enclav}_{ij} \\
&+\beta_{12} \mathrm{LangOff}_{ij} + \beta_{13} \mathrm{LangEthni}_{ij} + \beta_{14} \mathrm{zone}_{ij} \\
&+\emptyset_1 \mathrm{uemoa}_{ij} + \emptyset_2 \mathrm{Tec}_{ijt} + \emptyset_3 \mathrm{Pac}_{ijt} \\
&+\gamma_{ij} + \varphi_{ijt}
\end{aligned} \tag{4}$$

Justification of variables and expected signs

The explained variable ln(COM_{ijt}) represents agricultural trade, i.e. the logarithm of imports M_{ijt} of agricultural products from country i to country j or the logarithm of exports X_{ijt} of agricultural products from country i to country j over a period t. The choice of imports is motivated by the quality and availability of the data. Indeed, data on imports are generally reported more cautiously with regard to the duties and taxes to be collected [5]. However, some authors give priority to export data [4, 18]. In this research, trade in agricultural products is assessed separately by bilateral imports lnM_{ijt} and bilateral exports of agricultural products lnX_{ijt} to compare the effect of the nature of trade data on the impact of regional integration.

For the product of GDP ln(Y_{it} Y_{jt}), as well as the size of the population ln($POP_{it}POP_{jt}$), the expected sign is positive because the more countries develop, the more there is a tendency for trade to increase - these are indicators of potential market size. The variable ln($Terre_{it}Terre_{ij}$) measures the logarithm of the product of the arable land areas of countries i and j. It provides a partial measure of the supply capacity of the partner countries. The expected sign of the coefficient of this variable is positive, given the existing literature.

The logarithmic distance ln($Dist_{ij}$) is used to estimate the cost of transporting agricultural products from one country to another. Geographically very distant countries have to bear higher costs, this is a factor that negatively affects trade, so the sign of the distance should be negative.

The impact of transport infrastructure is measured by the indicator ln(Infratit). Poor transport infrastructure or inefficient transport services result in higher direct transport costs and longer delivery times. According to a study by [11], the variable ln(Tcr_{ijt}) corresponds to the logarithm of countries' bilateral real exchange rates.

This variable takes the value of 1 when one of the countries uses a floating exchange rate regime and 0 if it does not. The variable Proxyijt is a variable introduced into the model as an indicator variable for trade facilitation incentives, its coefficient shows the impact of trade facilitation measures on official bilateral trade. It is represented by the proxy variable as a variable of trade agreements implemented between countries.

On the one hand, sharing a common border influences the production and trade of agricultural goods through geographical proximity. Through the variable dummy Ad_{jijt} which takes the value of 1 when the two countries share a common border and 0 if not. The landlocked variable Enclavij, assesses the effect of openness to the sea on trade. It takes the value of 1 if at least one of the countries is landlocked and 0 otherwise. Empirical work on the past shows that countries with common colonisers have greater bilateral trade. The importance of the common language as an explanatory factor for trade links has several foundations, each of which relates to an aspect of the argument that defends the importance of border effects.

One of the simplest explanations is the transaction costs argument put forward by [25], which states that just as language barriers make communication more expensive, the absence of a common language between two potential trading partners increases the economic distance between them. The use of a common language can help establish bonds of trust and create networks of shared institutions to promote the dissemination of material. Having a common language should therefore have a positive impact on trade between countries. For example, the WAEMU countries should be trading a lot of agricultural products. Therefore, a positive sign on

bilateral trade in agricultural products is expected from the common colonising variables $ComCol_{ij}$, common official language $LangOff_{ij}$ and common ethnic language LangEthniij due to consumption habits.

The variables Tec_{ijt} and $uemoa_{ijt}$ make it possible to measure the supposed positive effect of regional integration. It captures the impact of the establishment and common external tariff in the WAEMU on trade in agricultural products between member countries. Indeed, thanks to the deepening of economic integration with the lowering of tariffs and the implementation of community programmes in the field of infrastructure and agriculture could stimulate trade in agricultural products. The variable Tec_{ijt} reflects the effects of the implementation of the WAEMU common external tariff from the year 2000. For pairs of WAEMU countries, it is 1 and 0 for the others. The variable pac_{ij} is a variable introduced into the model to capture the effect of integration policies through agriculture. Its coefficient shows the impact of the offensive measures taken by the Heads of State to promote food sovereignty.

The variable $zone_{ij}$ is a binary variable equal to 1 if the importing (exporting) country is a member of the Union excluding the exporting (importing) country and zero otherwise. It takes on names according to the estimated trade indicators muemoaoij for imports and $xuemoao_{ij}$ for exports. New trade corresponds to the case where the increase in intra-zone trade is not accompanied by a reduction in trade flows between the countries in the zone and their external partners. The effect is analysed according to the adoption of the combination of the two agricultural policies.

The term γ_{ij} constitutes the stochastic error while φ_{ijt} is an effect specific to each pair of countries, fixed or random.

The estimation steps of the model will be presented followed by the estimation results, interpretation and hypothesis testing.

Results and Discussion

Result of the Hsiao test

With a rejection of the null hypothesis (H03) of homogeneity of the constants, the panel presents a model with individual effects. Since the probability of test 3 is less than 5%, the null hypothesis (H03) of homogeneity of the constants is rejected, giving a panel model with individual effects.

Table 1 - Result of the Hsiao test

	Importations	Exportations
F-statistic	2.2579531	1.7870851
P-value	0.00702	0.042

Source: Author based on STATA 15 software

The Hsiao test was used to select the model specification. The panel respects the individual effect structure. Indeed, for exports the P-valF3=0.042<0.05 and for imports the P-valF3 = 0.00702<0.05. The null hypothesis H0 of a panel with a totally homogeneous structure for the two variables is rejected. We accept the alternative hypothesis H1, that our panel has an individual effect. The question here is whether the effects are fixed or random. This question leads us to carry out the following two tests: the Hausman specification test and the Lagrange multiplier test, also known as the Breusch-Pagan test.

Results of the Hausman test

Table 2 - Results of the Hausman test

	Importations	Exportations
chi2(17) = (b-B)'[(V_b-V_B)^(-1)](b-B)	211.26	329.65
Prob>chi2	0.0000	0.0000

Source: Author based on STATA 15 software

For exports and imports the p-value = 0.0000 < 0.05, so the individual fixed effect model is preferred. The probability of the Hausman test is below the 1% threshold, so the null hypothesis is rejected. The fixed-

effect model is therefore preferred. We will perform the Breusch-Pagan test for the presence of a random effect to confirm the result of the Hausman test.

Result of the Breusch-Pagan test

When the probability of this test is lower than the chosen threshold, the fixed-effect model is preferred. Otherwise, the random effect model is used.

Table 3 - Heteroskedasticity test

	Importations	Exportations
chi2(1)	971.94	1279.37
Prob>chi2	0.0000	0.0000

Source: Author based on STATA 15 software

When the p-value of the test is less than 5%, H0 is rejected. Otherwise, H0 cannot be rejected. Since the probability of the test on the two indicators is 0.000 < 5%, the null hypothesis is rejected. The test therefore accepts the specification of a compound error structure or the presence of random effects.

Since the two tests are in contradiction in our analysis, we will opt instead for the two models, fixed effect and random effect, to which we have decided to add the PPML model in order to invalidate or confirm the results obtained in the event of contradiction.

Model validation

In our study, we retain the PPML as the main estimation technique with reference to and [3]. The other estimation techniques (fixed effect and random effect) will allow us to test the sensitivity of our results. We estimate the panel augmented gravity model after adding to each bilateral trade value the arbitrary value of 10 so that the considered trade value is $\ln(COM_{IJT}+10)$.

Table 4 - Estimation results using bilateral exports as the explained variable

	ESTIMATING METHOD		
VAR	FIXED EFFECTS	RANDOM EFFECT	PPML
ln(yij)	-0,009	0,33	0,52
	(0,88)	(0,00) ***	(0,05) *
ln(popij)	0,81	-0,527	0,27
	(0,00) ***	(0,59)	(0,57)
ln(terreij)	-0,50	-0,14	-0,47
	(0,00) ***	(0,01) **	(0,01) **
ln(dist)	-0,22	-0,15	0,47
	(0,00) ***	(0,00) ***	(0,00) ***
ln(infrati)	-0,29	-0,07	0,06
	(0,00) ***	(0,1)	(0,00) ***
ln(infratj)	0,10	0,008	-0,50
	(0,1)	(0,87)	(0,02) **
ln(tcr)	-0,17	-0,19	-0,66
	(0,00) ***	(0,00) ***	(0,00) ***
Proxy	0,12	0,17	0,68
	(0,14)	(0,03) **	(0,13)
Front	0,76	0,84	1,66
	(0,00) ***	(0,00) ***	(0,00) ***
Comcol	1,10	1,11	-0,72

	ESTIMATING METHOD		
VAR	FIXED EFFECTS	RANDOM EFFECT	PPML
	(0,00) ***	(0,00) ***	(0,2)
Enclav	0,01	0,07	0,24
	(0,87)	(0,28)	(0,4)
lang_off	-1,05	-1,23	1,65
	(0,00) ***	(0,00) ***	(0,02) **
lang_ethni	0,46	0,75	0,28
	(0,00) ***	(0,00) ***	(0,3)
Xuemoa	0,13	0,39	0,37
	(0,52)	(0,00) ***	(0,2)
Tec	-0,56	-0,41	-0,71
	(0,00) ***	(0,00) ***	(0,06) *
Pac	0,13	0,01	0,26
	(0,16)	(0,85)	(0,62)
Uemoa	0,06	0,34	1,67
	(0,72)	(0,00) ***	(0,00) ***
Cons	-5,12	-4,67	-13,34
	(0,00) ***	(0,00) ***	(0,00) ***
Observations	3360	3360	3360
Number of pairs of countries	224	224	224
Chi 2		1210,23	
f-stat	64,46		
Proba		0,00	0,00

Source: Author based on STATA 15 software.
Probabilities are in brackets. (***), (**), (*) Significant at 1%, 5% and 10% respectively. For the Fixed Effects and Random Effects estimation methods, the explained variable is (ln(X)=export+10). For the PPML method, the explained variable is (export) without correction for zero trade.

Table 5 - Estimation results using bilateral imports as the explained variable

	ESTIMATING METHOD		
VAR	FIXED EFFECTS	RANDOM EFFECT	PPML
ln(yij)	0,19	0,16	1,06
	(0,00) ***	(0,00) ***	(0,00) ***
ln(popij)	-0,11	0,17	-0,35
	(0,37)	(0,12)	(0,15)
ln(terreij)	0,002	-1,99	-9,95
	(0,98)	(0,02) **	(0,00) ***
ln(dist)	-0,23	-0,20	0,72
	(0,00) ***	(0,00) ***	(0,00) ***
ln(infrati)	-0,36	0,18	-0,69
	(0,00) ***	(0,00) ***	(0,00) ***

	ESTIMATING METHOD		
VAR	FIXED EFFECTS	RANDOM EFFECT	PPML
ln(infratj)	0,30	-0,12	-0,02
	(0,00) ***	(0,03) **	(0,93)
ln(tcr)	-0,07	-0,20	-0,74
	(0,01) **	(0,00) ***	(0,00) ***
Proxy	0,88	0,45	-1,04
	(0,35)	(0,00) ***	(0,00) ***
Front	0,86	0,94	1,4
	(0,00) ***	(0,00) ***	(0,00) ***
Comcol	0,44	0,92	4,33
	(0,01) **	(0,00) ***	(0,00) ***
Enclav	0,39	0,25	-0,98
	(0,00) ***	-0,28	(0,00) ***
lang_off	0,06	-0,44	-6,38
	(0,71)	(0,00) ***	(0,00) ***
lang_ethni	0,18	0,32	2,16
	(0,02) **	(0,00) ***	(0,00) ***
Xuemoa	-0,16	-0,39	-2,15
	(0,46)	(0,00) ***	(0,00) ***
Tec	-0,62	-0,41	1,15
	(0,00) ***	(0,00) ***	(0,00) ***
Pac	0,11	-0,15	0,37
	(0,29)	(0,1)	(0,58)
Uemoa	0,29	0,33	2,50
	(0,16)	(0,00) ***	(0,00) ***
Cons	-0,37	-2,29	-19,67
	(0,65)	(0,00) ***	(0,00) ***
Observations	3360	3360	3360
Number of pairs of countries	224	224	224
Chi 2		1012,71	
f-stat	38,24		
Proba	0,000	0,000	0,000

Source: Author based on stata 15 software.
Probabilities are in brackets. (***), (**), (*) Significant at 1%, 5% and 10% respectively. For the Fixed Effects and Random Effects estimation methods, the explained variable is ln(M)= (import+10). For the PPML method, the explained variable is (import) without correction for zero trade.

Interpretation of results

The development variables are the product of the GDP taken in logarithm ($\ln(Y_{it}Y_{jt})$), the logarithm of the product of the populations ($\ln(Pop_{it}\ Pop_{ij})$) are indicators of the potential size of the market and the infrastructures. GDP is significantly positive but has different thresholds depending on the trade indicator.

Similar results were found by Martínez-Zarzoso and Nowak-Lehmann [13] for Mercosur-EU trade. According to these authors, the positive influence of this variable on trade is due to the fact that exporting countries with higher incomes suggest higher levels of production, and importing countries with higher incomes imply higher purchasing power.

The variable population is significantly positive for imports but not for exports. In terms of imports, the result can be explained by the fact that an increase in population leads to a reduction in agricultural exports, insofar as an increase in population leads to a reduction in a country's wealth, which in turn weakens its capacity to export goods. Walsh notes that «Population size can have a negative effect on exports if countries export less as they grow (because they rely more on domestic trade) or a positive effect if they export more as they achieve economies of scale. Population size will have a similar effect on imports» [24].

The parameters associated with the infrastructure variables are all negative, even though the parameter for partner country infrastructure is not significant for imports. In fact, the negative sign corroborates the literature, as indicated in the 2011 report on international trade [14], the poor development of transport infrastructure considerably increases the logistical costs of trade in agricultural goods [16]. The region's transport infrastructure is less developed, and this hinders countries' access to intra-regional markets. The quality of the region's infrastructure increases the logistical obstacles.

The availability of agricultural land influences the economic specialization of countries in the agricultural sector. Countries with large areas of cultivable land can specialize in the production of agricultural commodities and agri-food products, which can lead to specific trade in these areas. This is the case in ECOWAS, with several countries producing the same commodity. This confirms the negative sign of the coefficient associated with the land variable.

The socio-cultural variables in this study are the colonial past shared by the partners, the common colonial variables (ComColij), the common official language (LangOffij) and the common ethnic language (LangEthnoij). They determine consumption habits.

The Lang-off variable has a significant impact on both trade indicators. It has a negative effect on imports because, in ECOWAS, countries with the same official language generally trade more than others. In contrast, the ethnic official language is only significant for imports with a positive sign. In the literature, the effects of a common language on trade are generally positive and significant. With regard to the positive sign of the common language, Montenegro and Soloaga obtained the same results when estimating the impact of NAFTA on trade flows between the United States and Mexico and third countries [17]. The reason for this is either the ease of communicating in the same language, or cultural similarity between countries that share the same language.

The positive coefficient on distance is contrary to the literature in the context of the gravity model. The result, which is consistent with economic theory, shows that an increase in distance leads to a decrease in trade, since the greater the distance between two countries, the higher the transport costs and, consequently, the higher the prices of goods, which leads to a reduction in the competitiveness and trade of the country with its partner. Our result therefore contradicts the literature. The most logical explanation would be that political stability has an effect on bilateral agricultural trade in Africa. This effect seems contrary to expectations. Indeed, the study period marks a period of political instability in certain countries, especially those of the WAEMU. In the event of a political crisis, the country's production system is paralysed and the country is heavily dependent on imports of agricultural products from its regional partners. Trade with other countries in the zone is therefore at a higher level. It therefore costs more to transport a good as the distance increases in these unstable zones, and the sign is in line with the study by Walsh [24].

The effects of the Regional commercial rate (RCT) on international trade have been studied at length and have produced different results. Moreover, the negative and significant impact of the real exchange rate on trade seems to indicate that an appreciation of the currency of the exporting country against that of the partner country has the effect of reducing its exports to the partner. This result also extends to imports insofar as the parameter associated with it in the regression is positive whatever the trade indicator used. The RCT

has a significant influence since it determines the relative cost of products on the international market. In the same vein, Kepaptsoglou and al point out that the devaluation of the local currency in developing countries has an impact on international trade [10].

The variable that enables us to capture trade facilitation through the signing of trade agreements is not significant for the two trade indicators. These results are in line with the studies by Cegloswski [8] and Kimura and Lee [9] which showed that trade agreements were not significant.

The border effect is positive on both trade indicators, which shows an intensification of trade, unlike the border effect between Canada and America, which can be explained by the volatility of exchange rates, as there are several currencies with different exchange rate regimes in ECOWAS. It should be noted that there is a widely accepted notion of the positive and significant influence of the border effect on international trade. This is indicated by the evidence found in Masudur and Arjuman [14].

The main variables of interest in this research are WAEMU, CET and the CAP, which allow us to understand the supposed positive effect of regional integration.

The CET variable, considered here as the Common External Tariff, has a dual effect on bilateral trade, being positive and significant at the 1% threshold for imports and negative at the 5% threshold for exports. Contrary to the conclusions of Rose [20] and the reports of the Central Bank of West African States (CBWAS) and the WAEMU Commission, the WAEMU CET has failed to achieve its objectives. In fact, it was introduced to reduce imports from non-member countries of the union to the benefit of member countries. It should therefore logically increase exports from the union to third countries.

The WAEMU variable, which is designed to capture the effect of the WAEMU RTA on the trade flows of its member countries, is positive and significant. It therefore has a positive impact on member countries' trade. All other things being equal, countries belonging to this union trade more than other countries. This result is in line with that found by Gbetnkom and Avom [2].

The lack of significance of the combined effect of agricultural policy (ECOWAP /SADP) on intra-ECOWAS trade induced by the variable Pacijt is in contradiction with the literature, but the positive sign is in agreement with Tchitchoua and [22]. Given that the adoption of this policy was aimed at achieving food security in the zone by filling certain gaps, this can be explained by several reasons, starting with the existence of structural rigidity. ECOWAS has a coexistence of RECs. It may also be due to divergent agricultural policies and heterogeneous agricultural structures, but above all to the political and social sensitivity of the sector. The issue of import diversion of agricultural products is ruled out by the positive sign and insignificance of the β14 coefficient in our estimation.

Hypothesis testing

Agriculture plays a crucial role in the Economic Community of West African States (ECOWAS) due to its vital importance for food security, rural livelihoods and its economic contribution. The development and promotion of sustainable agriculture in the region is essential to ensure economic prosperity and improve living conditions. Given the importance of agriculture and trade in this study, three hypotheses were tested, namely in (1) the effect of regional integration on trade in agricultural products in ECOWAS varies with the level of regional integration (UEMOA) and economic development; (2) regional integration increases trade in agricultural products in ECOWAS through the common external tariff and (3) the combination of agricultural policy (ECOWAP/SADC) intensifies trade in agricultural products in ECOWAS.

The first hypothesis is verified, given the positive significance of GDP and the negative significance of transport infrastructure on trade indicators. In addition, the population variable is significantly positive for imports but not for exports. For the second hypothesis, the effect of the common external tariff varies according to the chosen trade indicator, so it is verified for imports, but for exports the tec tends to reduce them in ECOWAS. Our third hypothesis is not verified because the variable that captures the effect of the combination of the two agricultural policies is insignificant. This is because agricultural integration policies can be constrained by structural rigidities, such as geographical constraints, climatic differences and productivity differences between regions. The agricultural sector is often politically and socially sensitive.

Governments can be reluctant because of their concern for food security, the preservation of rural employment and the protection of local producers. Another very important factor that could explain this is that farmers' needs and priorities can vary considerably from one country to another, making it difficult to coordinate and implement common policies. It is important to note that the integration of agriculture in ECOWAS is an ongoing and complex process, and the effects may vary from one area to another and from one country to another. Achieving more meaningful integration will require further efforts to overcome obstacles and strengthen cooperation and coordination mechanisms at regional level.

Conclusions

The aim of this study is to analyze the effects of regional integration on trade in agricultural commodities in ECOWAS. The objectives of the study are firstly to identify the effect of regional integration and the factors influencing agricultural commodity flows in ECOWAS; secondly to examine the effect of trade policies on trade in agricultural commodities in ECOWAS; and thirdly to assess the implications of the effect of regional integration on trade in agricultural commodities in ECOWAS. The study shows that regional integration is based primarily on the conclusion of intra-regional trade agreements. The West African region is no exception, as it has also adopted a number of agricultural policies (ECOWAP/SADC) to intensify production and market these products (common external tariff). The theoretical background to the literature is that there are channels through which regional integration has a significant influence on trade. In terms of the trade flow analysis, the gravity model is one of the most successful empirical models in economics, and this has made it possible to capture the effects of regional integration on trade in agricultural products. Variables were included in the model to provide a simplified representation of intra-ECOWAS trade patterns. Three methods were used to estimate intra-ECOWAS trade over the period 2005-2020. Several variables were found to be significant for both indicators, although the effects were different. The PPML estimates allow us to verify our first two hypotheses, but the third is not verified.

In particular, the combination of ECOWAP (Economic Community of West African States Regional Agricultural Plan) and CAADP (Comprehensive Africa Agriculture Development Programme) is of considerable importance for agriculture in the ECOWAS region. Both ECOWAP and CAADP aim to improve agricultural productivity, strengthen food production systems and increase food availability. For the combined effect of the two agricultural policies to be significant, ECOWAP and CAADP must pay particular attention to sustainable rural development and poverty reduction. These initiatives will aim to improve the livelihoods of rural populations by promoting access to agricultural resources, basic infrastructure, financial services and agricultural markets. As regards the common external tariff, which influences bilateral trade, in order to achieve more conclusive results, it must involve all countries without exception. In particular, the WAMZ countries must ensure that it is effectively implemented, thereby giving fresh impetus to the process already begun by the WAEMU zone.

By combining these two initiatives, we can expect to achieve a significant improvement in food security in the ECOWAS region by increasing agricultural production, reducing food imports and strengthening farmers' resilience to economic and infrastructure development shocks.

The integration of agriculture in ECOWAS may not yet have reached the expected level of significance, but the prospects for the combination of ECOWAP and CAADP are promising. By strengthening the coordination, implementation and monitoring of agricultural policies and investments in the ECOWAS region, we can expect to see an increase in agricultural productivity, improved food security, a reduction in rural poverty and greater resilience in the face of current and future challenges. However, the full achievement of these objectives will require the continued commitment of governments, development partners and stakeholders.

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Effects of regional integration on trade in agricultural products in ECOWAS

N'Goran Koffi Célestin
PhD in Economics, Senior Lecture,
University Peleforo Gon Coulibaly of Korhogo, Côte d'Ivoire
E-mail: nkoffiagos2012@gmail.com

Titova Liudmila Anatolievna
PhD in Economics, Associate Professor,
Yaroslavl State University named after P.G. Demidov, Yaroslavl, Russian Federation
E-mail: luxe22@yandex.ru

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agriculture integration, regional integration, agriculture trade, ECOWAS, common external tariff, gravity model, zero trade, agricultural policies

ABSTRACT

The agricultural sector in ECOWAS faces low exchange volumes compared to other regions. Developing agricultural production and trade is crucial for achieving food security, that is priority for member nations. Aimed and strengthening production systems enhance intra-community commerce and integrate regional markets. However, ECOWAS's diverse agricultural potential is hindered by fragmentation and the difference in national interests, making integration vital for fostering intra-regional trade. We intend to identify the effects and influencing factors on agricultural commodity flows. The objective of this study is to analyze the effect of the regional integration on the trade of agricultural raw materials of the fifteen ECOWAS economies over the period 2015-2020. This question was addressed using a gravity model. The methodological approach is essentially based on several models. The Hsiao test, the Hausman test, the Heteroskedasticity test were used to analyse models' specifications. The Pseudo Maximum Likelihood Poisson estimate of this model indicates that the level of development of countries through the wealth, quality of infrastructure and the level of regional integration have an influence on trade but the different effects. The combination of agricultural policy (ECOWAP/PDDAA) has not achieved its objectives, it has no effect on trade. Moreover, the common external tariff has a different effect depending on the trade indicator chosen. Comprehensive implementation of the common external tariff across all ECOWAS countries is necessary to enhance bilateral trade. The agricultural policies must be coordinated and systematically monitored to improve their productivity, food security, and rural livelihoods. Thus, integration of agricultural trade within ECOWAS shows significant potential.