



Citation: A. Mancal, G. Sant'Ana de Camargo Barros (2019) Determinants of West African international agricultural trade. *Italian Review of Agricultural Economics* 74(1): 3-17. doi: 10.13128/REA-25476

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Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Determinants of West African international agricultural trade

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Abstract. Agricultural production is clearly an important component of West African international trade. Purpose here is to identify determinants of West African international trade flows. For this, the expanded Structural Gravity model was used. The overall pattern of international agricultural transactions in this region is dominated by extra-regional transactions and there are differences between intra- and extra-regional determinants. In global transactions, flows are higher among the Economic Community of West African States (ECOWAS) member countries and the West African Economic and Monetary Union (WAEMU) does not significantly affect those flows. On the other hand, ECOWAS does not have significant impact on intra-regional agricultural trade and flows are greater among WAEMU member countries.

Keywords: West Africa, international trade, agricultural, intra and extra-regional determinants.

JEL codes: F14.

1. INTRODUCTION

Commercial transactions resulting from productive activities in West Africa, both internal and external, are concentrated in the agricultural sector. Speeding up integration and improving the trading capacity of countries are some of the main goals of regional policies. The agricultural sector is recognized as a potential driver of the economy and regional investments provide incentives for its development.

Improving agricultural trade in West Africa is a crucial step for promoting the integration of local farmers into the global trade system. The region's comparative advantages for agribusiness provide conditions that can be exploited to build a productive system that can actually improve the living conditions of its population and reduce its external dependence. The fast progress seen in communications services has shortened the distances between countries, facilitating and creating opportunities for more intense economic transactions. Traditional barriers are inefficient and unsustainable both to protect and to stimulate economic development and ensure a high level of international competitiveness. The possibility of exploiting natural competitive advantages - land, sunshine and water - appears as a window available

to West Africa. All the major world nations in the past have played a major role in world trade and the importance of international trade in improving living conditions is, for some authors, an unquestionable fact (Appleyard, Field Jr, 2014).

Although the region consists of predominantly agricultural countries, the heterogeneities that make them complementary create intra-regional trade possibilities that can boost development. Added to this are regional investments in regional integration transportation infrastructure. Trade, especially regional trade, plays a major role in promoting economies of scale in production, whose potential is high in West Africa, given the unique traits of the region's countries (WB, 2015). According to FAO (2015) data for 2013, West African agricultural exports and imports accounted for 1.82% and 2.79% of Gross Domestic Product (GDP) in that year, respectively, indicating low integration and trade deficits.

The low level of agricultural exports reflects the low production levels of the countries and concentration of commercial agricultural production in raw material, as dictated by the region's current trade patterns. Given these conditions, identifying determinants of agricultural trade flows is fundamental for decisions aimed at improving their performance. And the objective of this investigation is to identify determinants of international agricultural trade flows in West Africa.

2. WEST AFRICAN INTERNATIONAL AGRICULTURAL TRADE AND EMPIRICAL APPLICATION OF THE GRAVITY MODEL

Between the 1990s and the 2000s, trade among developing countries grew significantly and transactions in the manufacturing sector quintupled. Considering only agricultural products, it more than doubled (Dethier, Effenberger, 2012). The primordial objective of West Africa's two main regional organizations – the Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union (WAEMU) – is to intensify trade between countries in the region as part of their regional integration policies. The growth of trade among countries in the region is enhanced by the actions of regional organizations (Torres, Van Seters, 2016).

Actions for this purpose are focused on developing regional transportation infrastructures and on unifying regional control systems. Regional organizations, in particular WAEMU, have a strategic plan for developing the transportation infrastructure, which consists of cross-country linkages and internal links within countries to

regional infrastructures (JICA, 2012). ECOWAS regional integration efforts include building a common community market, characterized by the free movement of people and goods between member states, and a common monetary zone (ECOWAS, 1999), as well as developing the transportation, communication, and energy infrastructure (ECOWAS, 2007).

Several studies on West African trade are concerned with tariff and non-tariff barriers between countries and the implementation of regional trade agreements (Engel, Jouanjean, 2013; Torres, Van Seters, 2016). These issues have been addressed by agreements at the level of regional organizations and their implementation is under way through regional supervision posts. Commercial tariffs among ECOWAS member states have been done away with for agricultural products produced within the region and the remaining barriers are weak to generate large impacts on trade (Cissokho, Houghton, Makpayo, Seck, 2012).

The political strategies designed to intensify regional trade transactions between the countries of the region's two main organizations - ECOWAS and WAEMU - are focused on the agricultural sector (Engel, Jouanjean, 2013; Torres, Van Seters, 2016). The heterogeneity of agricultural production within West Africa shows potential for efficient trade among countries in the region (Cissokho, Houghton, Makpayo, Seck, 2012). But intra-regional trade is small and undocumented, dominated by informality and concentrated in agricultural products (Torres, Van Seters, 2016). Despite all the efforts already undertaken, limiting factors such as high trading costs are still evident.

Transportation infrastructure constraints are the main causes of the high intraregional trade costs recorded in West Africa, although major investments in infrastructure were made in recent years (Torres, Van Seters, 2016). Regional investments in transportation infrastructure are leading to major transformations in the regional trade dynamics (ECOWAS, 2007; JICA, 2012; Torres, Van Seters, 2016). The global dynamics of international trade, however, reveals a reduced chance of gain for developing countries whose trade is focused on commodities (Appleyard, Field Jr, 2014).

The most recent model of international trade is the Gravity Model, which focuses on the determinants of trade flows. Unlike previous models, it does not explain the benefits and losses resulting from international trade, but the reasons that determine trade flows between countries. It focuses on the interactions between resistance and attraction to trade (Appleyard, Field Jr, 2014).

The gravitational econometric model has been widely used for investigating the determinants of trade flows

in empirical studies and has generated consistent results. It has been used to investigate the determinants of international trade patterns, which are in turn determined by income, distance, and other variables that affect trade flows (McCallum, 1995). In their empirical applications, other important variables that determine trade are included (Cissokho, Haughton, Makpayo, Seck, 2012; Head, Mayer, 2013; Magerman, Studnicka, Hove, 2015), such as regional trade policies. This model is mainly used to evaluate the impacts of trade policies (Head, Mayer, 2013), such as the effects of economic and monetary unions (Anderson, Van Wincoop, 2003).

The traditional Gravity Model considers only bilateral components in investigations of trade flows, but commercial relations between two countries are also affected by third parties. According to Anderson (2010), adjustments in the traditional model yield better results when other factors that affect trade are included, and bilateral constraints do not seem to fully explain trade flows. The multiple trade alternatives that exist simultaneously affect a bilateral trade relationship. This effect of other commercial alternatives on bilateral transactions is considered in the Structural Gravity Model (Anderson, Van Wincoop, 2003; Anderson, 2010), whose main characteristic is the multilateral resistance term (Head, Mayer, 2013). Debates on international economy generally depend on multilateral trade information, whose absence in gravitational models has been criticized as to its validity as a guiding instrument (Krugman, 1995). The inclusion of a multilateral resistance component in international trade allows for a solution to this problem of omission of a relevant variable to be investigated (Anderson, Van Wincoop, 2003).

Representing the multilateral resistance component of international trade in the empirical applications of the Structural Gravity Model is another specification problem. Using a constant term in time as a representation of multilateral resistance, as in Cissokho, Haughton, Makpayo and Seck (2012), the theoretical consistency and ease of application of which are highlighted by Head and Mayer (2013), does not seem plausible. This is so because bilateral relations change over time and, as a result, multilateral resistance must change. However, using specifications in investigating international trade patterns with real inconsistency seems reasonable until a more rigorous approximation appears (Krugman, 1995).

Besides the problems involved in specifying the term of multilateral resistance in empirical applications, representing trade flows in investigations of its determinants raises questions about its explanatory adequacy. The gravitational model can be considered from a demand or supply point of view, both of which work

for purposes of deduction or even to yield empirical results (Anderson, 2010). But trade flows are composed of imports and exports, and investigations of their determinants must involve both.

The reasons for exports may be totally different from those that drive imports. The volumes of the two can vary between countries due, among other reasons, to losses in trade and problems related to records. Unidirectional specification in the Gravity Model is consistent with the investigation of unidirectional determinants, as specified in a study on African exports (Czubala, Shepherd, Wilson, 2009). This fact requires a relevant theoretical foundation and deserves attention when specifying international trade flows using the Gravity Model. Incorporation of theoretical foundations into the Gravity Model has resulted in a better estimation and interpretation of the spatial interactions it represents (Anderson, 2010). A specification that encompasses the two directions of trade flows, as in McCallum (1995), is adequate to explain the determinants of trade between countries from parametric estimates.

In estimating the parameters of the Gravity Model, the results in terms of signals do not change with the method used, although the magnitudes of the effects vary (Magerman, Studnicka, Hove, 2015). This model assumes that the spatial distribution of goods and/or factors is determined by gravitational forces, which are in turn conditioned by the size of economic activities in each locality (Anderson, 2010). Empirical results confirm the assumptions of the model. Several studies have confirmed the economic assumptions about the relationship between distance, language, and shared borders with trade flows (Magerman, Studnicka, Hove, 2015). As pointed out by Anderson and Van Wincoop (2003) and Anderson (2010), factors other than those traditionally included in the models affect trade flows.

In the case of extra-regional trade in West Africa, flows seem to be driven by the raw material needs of its partners. The region's main trade partners are highly industrialized countries, to which it sells raw materials and from which it buys industrialized products (Torres, Van Seters, 2016). This is a fact common to developing countries and one that is characteristic of world trade. Global trade is dominated by industrialized countries and intra-regional transactions are more intense, African countries are nevertheless among the least performing in terms of intra-regional trade (Appleyard and Field Jr, 2014), despite their great agricultural potential and increasing demand for food products.

An increasing share of food supply in West Africa is imported, despite its great agricultural potential (WB, 2015). According to Torres and Van Seters (2016), the

region exports a small number of raw materials concentrated in extractive natural resources and imports industrialized products, including an increasing volume of food products. Its trade balance in food products has deteriorated over the last decade as a result of its population growth and increased purchasing power. Exports from low-income countries are concentrated in the agricultural sector (Dethier, Effenberger, 2012), which constitutes the main productive sector in West Africa.

3. METHODOLOGY

The data used in this investigation were obtained from the statistical department of the United Nations Food and Agriculture Organization (FAO), the World Bank (WB), the World Trade Organization (WTO), the Center for Prospective Studies and International Information (*Centre d'Études Prospectives et d'Informations Internationales* - CEPII), the Economic Community of West African States (ECOWAS), and the West African Economic and Monetary Union (WAEMU). The period of analysis is 1990 through 2013. For the estimation, unbalanced panel data composed of sixteen West African countries were used.

The model adopted in this research was the Structural Gravity Model developed by Anderson and Van Wincoop (2003), which is very much followed in this area's literature (Head, Mayer, 2013). It was developed from a cost function of Constant Substitution Elasticity (CES) and specified for a given economic sector - in this case agriculture (Anderson, 2010). This model is given by:

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

where X_{ij} are the agricultural exports of i -th country to j -th country, Y_i and Y_j represent international agricultural supply and demand - exports and imports - for i -th and j -th countries, respectively, Y^w are the world's agricultural exports, P_i and P_j are the consumer price indices of i -th and j -th countries, respectively, p_{ij} is the price paid by importer j to exporter i for a product, p_i is the producer price in the exporting country, the term $t_{ij} = \frac{p_{ij}}{p_i}$ is the trade cost factor between the two countries and p_i represents bilateral barriers, and σ is the parameter of substitution elasticity.

The terms P_i and P_j represent multilateral barriers and $\frac{t_{ij}}{P_i P_j}$ is the relative resistance to trade between two countries (Anderson, Van Wincoop, 2003). It involves

multilateral and bilateral resistance representing all trade costs.

After considering a stochastic form of equation (1), with an exponential error term and a parameter representing other determinants of trade flows not specified in the model, the equation was expressed in terms of a natural logarithm:

$$\ln X_{ij} = \beta + \beta_4 \ln e_{yy} + (1-\sigma) \ln t_{p} + \varepsilon \quad (2)$$

where: $\ln e_{yy} = \ln \frac{Y_i Y_j}{Y^w}$ and $\ln t_{p} = \ln \left(\frac{t_{ij}}{P_i P_j} \right)$. In this logarithmic specification, the consideration of null (zero) records for trade flows requires mathematical transformations of data for their computation, given the logarithmic indeterminacy of that value. Estimations of trade flows using the Gravity Model in its standard specification generate biased results by not allowing the inclusion of null records (zeros) in the investigation (Helpman, Melitz, Rubinstein, 2008). Fortunately, records of this type do not compose the database used in this investigation.

Possible effects of sharing a common border, *fron*, an official language, *ling*, a common economic community, *ceco*, a common monetary community, *cmo*, and an inverse distance between countries, *disv*, specified in equation (2), are given by:

$$\ln X_{ij} = \beta + \beta_1 \text{fron} + \beta_2 \text{ling} + \beta_3 \text{disv} + \beta_4 \text{ceco} + \beta_5 \text{cmo} + \beta_6 \ln e_{yy} + (1-\sigma) \ln t_{p} + \beta_i \text{Dum}_i \quad (3)$$

where: *fron*, *ling*, *ceco* e *cmo* are equal to one (1) if exporting and importing countries share these variables and zero otherwise, *disv* is the inverse distance in kilometers between those countries, Dum_i is equal to one for i -th country and zero otherwise and ε_{it} is the normally distributed random error term with zero mean and constant variance $\varepsilon \sim N(0, \sigma_\varepsilon^2)$.

Model (3) is used in this investigation of the determinants of global and intra-regional agricultural trade and model (4) is used for extra-regional agricultural trade in West Africa.

$$\ln X_{ij} = \beta + \beta_2 \text{ling} + \beta_3 \text{disv} + \beta_6 \ln e_{yy} + (1-\sigma) \ln t_{p} + \beta_i \text{Dum}_i + \varepsilon \quad (4)$$

In the model for extra-regional trade with the border term, the economic and monetary communities were omitted because the countries involved do not share them with their five main trading exporting and importing partners.

For estimating the parameters of the determinants of trade flows that consider exports and imports, the

dependent variable $\ln X_{ij}$, refers to agricultural exports to $t_{ij} = \frac{P_i}{P_j}$ and $\ln X_{ij}$ refers to agricultural imports to $t_{ij} = \frac{P_i}{P_j}$ – when P_i West Africa is the importing party and Y^w refers to global agricultural imports.

International agricultural transactions involving live animals (heads) were excluded from the investigation due to their incompatibility for determining average prices. It is worth noting that they account for a small volume of international agricultural trade in the region’s countries according to FAO bilateral records, but they are relevant to the living conditions of the local population. Trade in live animals is an important component of international trade patterns among West African countries, especially among those without a direct connection to the ocean (Hanink and Owusu, 1998).

4. RESULTS AND DISCUSSION

Agricultural transactions constitute the main productive component of the export basket of West African countries. Regional participation in international trade is focused on exports of raw materials and imports of final consumer goods. In the 2000s, regional agricultural exports and imports grew, but no change was recorded in the composition of transactions in terms of processing degree (ECOWAS^b, 2015). Transactions consist mainly of exports of raw materials and imports of industrialized products (Torres, Van Seters, 2016). Although the agricultural sector is the main driver of production and occupation in West African countries, agricultural imports are on the rise. This development reflects an imbalance and/or divergence in the basket of products between local supply and demand. Both the import and export rate of agricultural products gained momentum from the year 2000 (Fig. 1).

Identifying and understanding the determinants of West Africa’s international agricultural transactions is key for the regional planning of agricultural develop-

ment. In this investigation, the Structural Gravity Model was expanded with the inclusion of dummies for shared borders, official language, and regional economic and monetary communities, as well as for geographical distances between importing and exporting countries. The results of the estimates for West Africa are presented in Tables 1 (global transactions), 2 (internal flows), and 3 (foreign trade).

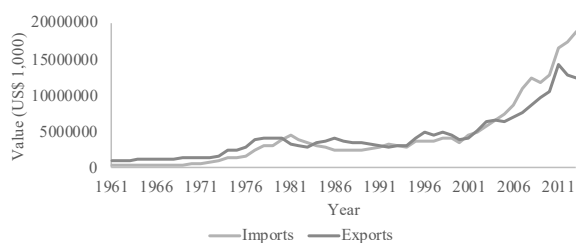
With the exception of the common currency, *cmo*, all the other variables considered in the Structural Gravity Model in this specific investigation significantly affect global agricultural trade flows in West Africa at a statistical significance of 1% (Tab. 1). Transactions grow as supply and demand from the region’s countries and their partners, *lneyy*, increase.

Increased regional agricultural production has a positive effect on international trade flows, especially on the sector’s exports. This shows the reduced pressure on internal depreciation of producer prices resulting from productive expansion in West African countries. In the region, intra-regional trade has a limited offer due to the low production levels recorded in the primary (agricultural) and secondary (manufacturing) sectors (Hanink, Owusu, 1998). As Allen and Heinrigs (2016) point out, food prices in the region are high relative to other regions with similar incomes. This relationship ensures the benefit of international transactions to agricultural producers in the region, whose limiting factor is the level of production of the countries.

While supply and demand boost international agricultural trade flows, restrictions have significant impacts on the process. Transportation costs are the most important bilateral component of resistance to trade in the region’s countries. Several studies have shown that exporting firms in Africa are those with the highest productive efficiency and capable of overcoming the limitations of high transportation costs (Van Biesebroeck, 2005). These costs are mostly incurred from the production gate to the flow ports, given the precariousness of the transportation infrastructure in rural areas of countries, particularly in West Africa. This is evident in the development strategies of regional organizations, such as in the strategic plans of WAEMU (JICA, 2012) and ECOWAS (ECOWAS, 2007) for developing transportation infrastructure.

As grounded by the Gravity Model, economic, social, and geographical approaches increase transactions between countries. Sharing a common border expands the agricultural trade of West African countries significantly in statistical terms. Agricultural trade in ECOWAS’ countries is positively affected by product level, a common language, and a common border, and is

Fig. 1. Evolution of the nominal value of West African agricultural imports and exports from 1961 through 2013.



Source: FAO, 2015.

negatively affected by geographical distance (Cissokho, Haughton, Makpayo, Seck, 2012).

The smaller the geographical distance, the greater the overall agricultural trade flows among West African countries, as shown by the result for reverse distance in the model, *disv*. In the research on the determinants of international trade, including West Africa, the negative relations of geographical distance and the positive effects of sharing a common language and border were confirmed (Baier, Bergstrand, 2007; Carrère, 2004; Nitsch, 2004).

Sharing the same official language, *ling*, significantly increases agricultural trade flows among West African countries. The relations between distance (negative) and sharing a common border and language (positive) and trade flows have been confirmed in research carried out by Helpman, Melitz and Rubinstein (2008) and consolidated in the literature. This contribution can be improved by implementing three official languages in the region, namely, Portuguese, English and French, as mandatory curricular subjects up to the last year of high school.

In addition to having intrinsic interactions, the definitions of which are given, West African countries are regional economic blocs. In the overall international agricultural trade, regional flows are statistically significant and more intense among ECOWAS member countries, *ceco*. That organization has been playing a decisive role in raising the level of trade in agricultural products through its investments in infrastructure (Cissokho, Haughton, Makpayo, Seck, 2012).

The coefficient of *ceco* reveals that international agricultural trade among ECOWAS member countries rises when transactions with all their trade partners are considered. This may be evidence of the shield resulting from the formation of this economic block in relation to outside partners. However, it may be the result of trade intensification among countries brought about by approaches promoted by the organization, without prejudice to the relations with extra-regional partners, which do not constitute a shield. Lower trade frictions induce transactions among non-trading countries and increases flows among partners already engaged in bilateral trade (Helpman, Melitz, Rubinstein, 2008).

There do not seem to exist barriers set up by ECOWAS for non-member countries, given that their common external rates are recent, launched in January 2015, and are not included in the period considered in this investigation. Their highest common external rate, 35%, which is lower than the upper limit of the bands consolidated in the World Trade Organization (WTO) by most countries, provides further evidence that support the degree

Tab. 1. Result of the estimation of determinants of both intra- and extra-regional international agricultural trade of West Africa.

<i>lnx_{ij}</i>	Coefficient	Standard error	z	p-value
<i>lneyy</i>	0.8114	0.0145	55.87	0.000
<i>ln_{tp}</i>	-0.0854	0.0198	-4.30	0.000
<i>fron</i>	0.8219	0.1107	7.42	0.000
<i>disv</i>	283.5323	30.0766	9.43	0.000
<i>ling</i>	1.5452	0.0723	21.37	0.000
<i>ceco</i>	0.9754	0.0977	9.98	0.000
<i>cmo</i>	-0.1798	0.1152	-1.56	0.118
<i>Benin (constant)</i>	-0.8114	0.2157	-3.76	0.000
<i>Burkina Faso</i>	-0.1824	0.1202	-1.52	0.129
<i>Cape Verde</i>	0.3288	0.1291	2.55	0.011
<i>Côte d'Ivoire</i>	0.0722	0.1038	0.70	0.487
<i>Gambia</i>	-0.2882	0.1284	-2.25	0.025
<i>Ghana</i>	-0.1042	0.1090	-0.96	0.339
<i>Guinea</i>	-0.7626	0.2864	-2.66	0.008
<i>Guinea-Bissau#</i>	-	(omitted)		
<i>Liberia#</i>	-	(omitted)		
<i>Mali</i>	-0.1876	0.1400	-1.34	0.180
<i>Mauritania</i>	-0.1511	0.1497	-1.01	0.313
<i>Niger</i>	-0.1128	0.1155	-0.98	0.329
<i>Nigeria</i>	-0.3716	0.1680	-2.21	0.027
<i>Senegal</i>	0.0817	0.1002	0.81	0.415
<i>Sierra Leone##</i>	-	(omitted)		
<i>Togo</i>	-0.2416	0.1081	-2.23	0.025
<i>sigma_u</i>	0	0.0239		
<i>sigma_e</i>	2.1574	0.0169		
<i>rho</i>	-	(omitted)		

Number of observations = 8,133

Log likelihood = -17,793.832 LR chi2(19) = 3,698.60

Prob > chi2 = 0.000

LR test of *sigma_u*=0: *chibar*2 (01) = 0.00

Prob >= *chibar*2 = 1.000

Omitted because their information on agricultural business transactions are not listed in the FAO Detailed Trade Matrix database as Reporting Countries. They only appear as partners of those that reported (Partner Countries).

Omitted because producer price information is missing on the bases consulted to determine t_{ij} .

of economic openness of countries in the region. This rate is mainly applied to agricultural products. With the exception of Cape Verde, Côte d'Ivoire, Liberia and Senegal, all other ECOWAS member countries adopt higher bands than the highest regional rate applied to agricultural products. It should be noted that the actual rates are usually lower than the upper limit consolidated by countries in the WTO (Appendix Tab. A.1). With the exception of Liberia, the level of economic openness of

countries is confirmed (Appendix Fig. A.1.). The end of two decades (1990-2000) of civil conflict in Liberia (LISGIS, 2009) was followed by large trade inflows into the country, which lost space for resuming local production and saw a reduction in economic openness. But unlike individual agreements, the actual implementation of regional common external rates does not allow for downward flexibility in tariffs, only for upward shifts. ECOWAS member countries have a 3% margin for changing their common external tariffs to adjust them to the rates individually agreed upon in the category of more favorable nations in the WTO if these are higher than the regional external rates adopted by the organization (DGIZ, 2014).

Greater protection for the agricultural sector appears to be standard in trade policies, even in central countries or in those experiencing a fast development process and with a high productive performance in the sector. Other protective mechanisms adopted for the sector, such as quality regulations, do not appear to be constraints for the West African agricultural market. Institutional shortcomings make it impossible to use these measures in the region, in particular for agricultural products. A limited coverage of specific agricultural products in WTO commitments corroborates a virtual absence of such restrictions (Appendix Tab. A.1.). Progress has been made in harmonizing regional and domestic policies in West Africa, but the region still faces restrictions to actually build a strong and dynamic common market mainly due to institutional shortcomings (ECOWAS^b, 2015).

West Africa has another large economic bloc, WAEMU, a monetary union made up of 50% of the region's countries that does not significantly affect their global agricultural international transactions, *cmo*. However, it is a major determinant of the region's internal trade flows, as will be discussed later. Monetary union raises trade flows between countries in the community by reducing transaction costs using a common currency and eliminating risks associated with exchange rate volatility (Carrère, 2004; Masson, Pattillo, 2004). But the result confirms that the global international transactions of WAEMU countries are not different from those of other ECOWAS member countries. One justification for this result lies in the composition of the international agricultural trade baskets of countries in the region and their directions. The largest share of these transactions is made up of outgoing raw materials and incoming finished products from countries with an advanced level of agricultural development outside West Africa, as pointed out by Torres and Van Seters (2016). This is a condition that dictates the behavioral pattern of glob-

al trade flows in the region and which may change as countries advance in terms of agricultural development. Increased agricultural processing and transformation and improved infrastructure are likely to redirect flows and/or reset the intensity of agricultural transactions. And the commercial advantages afforded by the monetary union will likely lead to a more intense agricultural trade among its member countries.

Regional blocs were formed in West Africa with the main purpose of intensifying relations between their member countries based on the liberalization of borders and trade. Developing the agricultural market is a priority in the region's discussions (Me-Nsope, 2014; Me-Nsope, Staatz, 2015). The behavior of internal and external international agricultural trade flows in the region must be differentiated. The strategies for the two dimensions will not be the same, although they are convergent in terms of improving the quality of life of local populations. This is evident in the trade policies adopted by ECOWAS and WAEMU, which seek to eliminate internal taxes and unify external ones. Regional treaties are more efficient in raising the level of intra-regional trade, especially in West Africa (Carrère, 2004).

In intra-regional international agricultural trade, factors of resistance (*Intp*), monetary unions (*cmo*), and particularities between countries increase trade flows between them. ECOWAS (*ceco*) does not affect internal transactions, as opposed to aggregate behavior. The effects of the other variables regarding directions and statistical significance did not change, despite their different magnitudes (Tab. 2).

Increased agricultural demand and supply enhance trade flows among West African countries, *lneyy*, and reveal that policies designed to expand production have a positive effect on internal transactions. The edaphoclimatic heterogeneities that make them complementary in agricultural production mitigate the depressive effect of increased production on prices. And increased regional agricultural imports reveal that local production needs can be met through market adjustments between local supply and demand. Although edaphoclimatic conditions reveal a potential for productive complementarity in West Africa, intra-regional trade is more intense in competitive rather than complementary products (Hanink, Owusu, 1998).

The low level of commercial agricultural production directed to the regional market is the main restriction preventing trade among countries from becoming more intense. Investment in transportation infrastructures and standardization of regulations yield benefits tied to private engagement in agricultural development. Harmonization of standards increases trade among coun-

tries, especially African exports (Czubala, Shepherd, Wilson, 2009). Regional convergence between supply and demand will speed up transactions between countries in the sector, for which purpose agricultural industrialization is fundamental to correct divergences.

In West Africa's internal agricultural transactions, the greater the multilateral constraints, the lower the flows, and the greater the bilateral ones, the larger the transactions between the region's countries, *lntp*. The result reveals contradictory directions between bilateral and multilateral resistance to trade. One of the justifications for the behavior of bilateral resistance lies in the concentration of transactions in border areas between countries, meaning that the high prices paid by importers do not reflect trading costs (except profits), but rather higher profit margins. Restrictions on international transactions have no significant influence on trade in border areas between West African countries (ECOWAS^b, 2015). The positive coefficient for *lntp* provides evidence that intra-regional agricultural trade is dominated by the movement of traders from one country to another rather than by transactions between exporters and importers from different countries. The share of production in the countries that meets regional demands moves between neighbors according to its best remuneration. This result corroborates the effects of sharing a common border and of geographical distance.

The positive contribution of shorter distances to trade flows provides evidence of the contribution of infrastructure investment, a challenge reserved for countries, given that regional infrastructures do not cover rural areas to a large extent. Several studies on international trade in sub-Saharan Africa have shown a negative relationship between trade and distances between countries (Buys, Deichmann, Wheeler, 2010). Regional investment packages, whose effectiveness requires simultaneous actions at regional level and complementarity among them at the level of the countries involved, is one of the strategies to ensure the expected benefits.

The role of unofficial languages in ensuring closer relations between West African countries, particularly in border areas, should be highlighted. Although official languages contribute positively to trade flows, the role played by unofficial languages is even more important in internal international transactions in the region due to the low schooling levels prevailing there. The peculiarities of local languages among the region's countries are one of the factors limiting trade flows (ECOWAS^b, 2015). Actions to improve their contribution through political interventions are restricted to promoting stability and sound coexistence among communities in border areas.

As opposed to official languages, traditional languages are not components of formal education and their learning results from acquaintanceship.

ECOWAS does not have a statistically significant impact, *ceco*, on internal international agricultural trade flows in West Africa. Buys, Deichmann and Wheeler (2010) found the same result in their investigation of trade flows in Sub-Saharan Africa. Contrary to studies by Cernat (2001) and Cissokho, Haughton, Makpayo and Seck (2012), who pointed out that trade increased between countries as a result of effects caused by ECOWAS, but these might reflect effects brought about by WAEMU – the monetary union – that were not controlled for in their investigations. Trade patterns in West Africa are not different from those that prevailed prior to the establishment of ECOWAS and the community has not been promoting trade between its member states effectively (Hanink, Owusu, 1998). The effects of its trade policies have not yet been felt in intra-regional transactions, in part because of the ongoing structuring efforts to promote liberalization effectively. The absence of these conditions is cause of the inefficiencies of trade blocs in Africa, as highlighted by Yang and Gupta (2008).

The impacts of intra-regional trade agreements in West Africa have not been actually felt so far because the required conditions to ensure their effectiveness are under construction, such as community checkpoints, regional standardization of products, and use of regional passports. Thus, the conditions that prevailed before those agreements were entered into force still affect commercial transactions in the region. Constraints related to the effective implementation of trade treaties raise questions as to their actual capacity to promote trade (Cernat, 2001). This fact constitutes one of the explanations for the insignificance of ECOWAS as a determinant of intraregional agricultural trade in the period under analysis.

Unlike other economic measures, the impacts of trade measures on transactional flows depend on their effective implementation, especially in West Africa. Due to the political fragility of African countries, the positive effects of anticipating trade agreements are unlikely to be verified (Cernat, 2001).

Bilateral costs are factors of resistance to international transactions, partly due to the exchange rate, which is eliminated by a monetary union when the countries involved in the transactions are both member states (Carrère, 2004; Masson, Pattillo, 2004). The WAEMU is the only African economic bloc that has been consistently boosting trade among its member countries (Yang, Gupta, 2008). The West African monetary

union, *cmo*, has been significantly expanding trade flows among its member countries. The impacts of the WAE-MU are not limited to reducing exchange rate costs, as the organization also invests in infrastructure, provides credit, and promotes macroeconomic stability. It may be difficult to distinguish the effects of a monetary union from those of other regional integration policies on international transactions, since they are usually overlapping effects, as is the case of those brought about by WAEMU (Masson, Pattillo, 2004). The monetary union in this community has boosted the impacts of intra-regional trade policies (CARRÈRE, 2004).

This result provides empirical evidence of the capacity of the monetary union in West Africa to speed up economic integration in the region. Accession of the other countries of the region to the WAEMU should be encouraged to ensure that the socioeconomic benefits it affords are expanded at the regional level. Establishing a monetary union that includes all West African countries is an intention of ECOWAS since it was set up, but political constraints in some of the region's countries and the higher priority given to other economic strategies have been delaying this process (Masson, Pattillo, 2004).

Increased intra-regional transactions will stimulate production oriented to this market and the economic exploitation of the unique aspects of West African countries. Specific individual effects may vary between those involved in a given commercial transaction and make a difference in defining trade flows (Helpman, Melitz, Rubinstein, 2008). Global analysis of West African agricultural trade suggests that countries are not taking advantage of the economic opportunities afforded by their complementarities in their edaphoclimatic heterogeneities. However, the results suggest an increase in the intra-regional transactions of specific countries, confirming that they are exploiting their peculiarities. The high trade potential among countries in the region is evident and capable of leveraging returns to scale (WB, 2015). This contradiction reveals the difference between the pattern of intra-regional trade, in which transactions of subsistence crop surpluses prevail, and the pattern of extra-regional trade, which is focused on the large-scale commercial production of raw materials.

Table 3 shows the estimation results of extra-regional determinants of West African agricultural trade. They reveal how the predominance of these transactions define the behavioral pattern observed in the global analysis and confirm that commercial agriculture is focused on producing raw material to be exported to markets outside the region. This composition of the commercial basket reflects the effects of trade liberalization on the region's development, which according to

Tab. 2. Result of the estimation of determinants of intra-regional international agricultural trade in West Africa.

<i>lnxij</i>	Coefficient	Standard error	z	p-value
<i>lneyy</i>	0.7257	0.0307	23.65	0.000
<i>lnltp</i>	0.0749	0.0339	2.21	0.027
<i>fron</i>	0.7854	0.1194	6.58	0.000
<i>disv</i>	316.3479	33.6849	9.39	0.000
<i>ling</i>	0.2909	0.1459	1.99	0.046
<i>ceco</i>	-0.1304	0.3458	-0.38	0.706
<i>cmo</i>	0.7530	0.1593	4.73	0.000
<i>Benin (constant)</i>	0.9574	0.5187	1.85	0.065
<i>Burkina Faso</i>	1.2791	0.2488	5.14	0.000
<i>Cape Verde</i>	1.8267	0.3874	4.72	0.000
<i>Côte d'Ivoire</i>	1.3623	0.2241	6.08	0.000
<i>Gambia</i>	1.1771	0.2834	4.15	0.000
<i>Ghana</i>	1.0664	0.2401	4.44	0.000
<i>Guinea</i>	1.8476	0.6530	2.83	0.005
<i>Guinea-Bissau</i>	-	(omitted)		
<i>Liberia</i>	-	(omitted)		
<i>Mali</i>	1.4483	0.2655	5.45	0.000
<i>Mauritania</i>	0.2772	0.5176	0.54	0.592
<i>Niger</i>	2.4347	0.2498	9.75	0.000
<i>Nigeria</i>	0.1956	0.4689	0.42	0.677
<i>Senegal</i>	1.5538	0.2119	7.33	0.000
<i>Sierra Leone</i>	-	(omitted)		
<i>Togo</i>	1.2464	0.2125	5.87	0.000
<i>sigma_u</i>	0	0.0454		
<i>sigma_e</i>	2.1306	0.0321		
<i>rho</i>	-	(omitted)		

Number of observations = 2,207
Log likelihood = -4,801.0085 LR chi2(19) = 925.95
Prob > chi2 = 0.000
LR test of sigma_u=0: chibar2(01) = 0.00
Prob >= chibar2 = 1.000

Shaik (2017) has a negative effect on the agricultural productivity of Sub-Saharan Africa. Most trade models according to which the greater the openness of economies, the greater the welfare of society ignore adjustment costs (Kerr, 2016). It has been emphasized in discussions that the African production framework has not changed and that its traditional share in international trade remains the same – that of a provider of raw materials – with little evidence that structural foundations capable of generating development have been actually laid (Nyarko, 2012).

Geographical distance does not have statistically significant impacts on these extra-regional flows. The needs between the partners involved, expressed in terms

Tab. 3. Result of the estimation of determinants of extra-regional international agricultural trade in West Africa.

$\ln x_{ij}$	Coefficient	Standard error	z	p-value
<i>lneyy</i>	0.8436	0.0172	49.03	0.000
<i>lntp</i>	-0.1267	0.0243	-5.22	0.000
<i>ling</i>	1.9689	0.0840	23.45	0.000
<i>disv</i>	561.0062	533.867	1.05	0.293
<i>Benin (constant)</i>	-1.2142	0.2821	-4.3	0.000
<i>Burkina Faso</i>	-0.5860	0.1371	-4.28	0.000
<i>Cape Verde</i>	-0.0079	0.1351	-0.06	0.953
<i>Côte d'Ivoire</i>	-0.1743	0.1159	-1.5	0.133
<i>Gambia</i>	-0.6811	0.1418	-4.8	0.000
<i>Ghana</i>	-0.3925	0.1204	-3.26	0.001
<i>Guinea</i>	-1.3437	0.3115	-4.31	0.000
<i>Guinea-Bissau</i>	-	(omitted)		
<i>Liberia</i>	-	(omitted)		
<i>Mali</i>	-0.5954	0.1678	-3.55	0.000
<i>Mauritania</i>	-0.4446	0.1613	-2.76	0.006
<i>Niger</i>	-0.8427	0.1294	-6.51	0.000
<i>Nigeria</i>	-0.7182	0.1787	-4.02	0.000
<i>Senegal</i>	-0.3626	0.1136	-3.19	0.001
<i>Sierra Leone</i>	-	(omitted)		
<i>Togo</i>	-0.635	0.1251	-5.08	0.000
σ_u	0	0.0274		
σ_e	2.1125	0.0194		
ρ	-	(omitted)		

Number of observations = 5,926
Log likelihood = -12,840.604 LR chi2(16) = 3,023.37
Prob > chi2 = 0.000
LR test of $\sigma_u=0$: chibar2(01) = 0.00
Prob >= chibar2 = 1.000

of supply and demand, make such distance irrelevant in defining those flows. As pointed out by Torres and Van Seters (2016), the transactions of West African countries are focused on countries that demand their raw materials and offer products that meet their final consumption needs. Consistent with the pattern of trade in the region's countries, this fact provides evidence of the potential for expanding transactions with nearby countries, especially other African countries. Raising the level of processing of agricultural products in the region is crucial for taking advantage of this opportunity.

5. CONCLUSION

The patterns of intra and extra-regional international agricultural trade in West Africa are different in

their determinants. Commercial production is directed toward extra-regional transactions and focused on raw material exports. Agricultural imports are in turn dominated by products destined to final consumption, given the low degree of agroindustrialization of the region's countries. This divergence between regional agricultural supply and demand limits the intra-regional intensity of international trade in the sector.

Although logistic costs impact West Africa's extra-regional agricultural transactions negatively, geographical distance does not significantly affect these flows. Needs expressed in terms of supply and demand forces overlap logistical constraints in such transactions. However, the intensity of trade within the region is greater between geographically closer countries. And in both intra- and extra-regional flows, sharing a common official language increases international agricultural transactions.

In West Africa's global agricultural transactions, flows are higher among ECOWAS member countries and the monetary union has not affected them significantly. The greater intensity of transactions between ECOWAS member countries is not due to any economic closure promoted by the bloc, but rather to the fact that they constitute a natural cluster based on their geographical distribution and cultural bonds. ECOWAS has not affected the degree of economic openness of its member countries, as its external rates are recent and generally lower than those agreed upon by them at the World Trade Organization (WTO). To a large extent, its trade policy has not been effective due to institutional and infrastructural constraints.

As for the non-significance of the West African Economic and Monetary Union (WAEMU) effect, it is justified by the regional divergence between agricultural supply and demand and by the concentration of commercial production of West African countries in products destined for extra-regional trade. And because the extra-regional pattern is dominant in the aggregate, the effects brought about by the monetary union have not been reflected in the region's global agricultural flows.

In intra-regional international agricultural transactions, ECOWAS has not significantly affected trade flows between countries. On the other hand, these flows are higher among WAEMU member countries. The institutional and infrastructural limitations that have been preventing the effective implementation of the ECOWAS trade policy are the causes of its ineffectiveness in boosting trade in West Africa. In contrast, the monetary union has intensified trade between member countries partly because of its immediate effects, particularly the elimination of exchange rate costs.

For the international agricultural transactions of West African countries to be redirected and intensified, agro-industrial development must be promoted in the region to increase domestic consumption of raw materials and local supply of products with a high degree of processing. The formation of physical capital in this process must be reserved to the private sector, while the public sector should create a favorable macroeconomic environment and provide incentives and credit adjusted to the local context in terms of finance.

Finally, in addition to the empirical application of the Structural Gravity Model to the specific context of West Africa's agricultural sector, bidirectional specifications of flows and components of bilateral resistance are scientific contributions of this investigation. The unidirectional flow specification implicitly excludes information, particularly on costs, from importing countries between the border and final consumers. And the bidirectional one incorporates such information by considering the exports of both parties, including for the most remote parts of the countries between the gate and the border. Although information on imports is not exactly lost, this is the best approximation possible for this investigation.

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APPENDIX

Tab. A.1. Average external tariffs (ad valorem) of West African countries, ECOWAS, WAEMU, South Africa, Brazil, China, United States of America, and the European Union.

Individuo	Simple average of upper limit (final bound) ¹			Simple average applied to the most favored nations (MFN applied) ²			Trade weighted average ³			Binding coverage ⁴	
	Tot	Ag	NAg	Tot	Ag	NAg	Tot	Ag	NAg	Tot	NAg
Benin	28.3	61.8	11.3	12.2	15.8	11.5	11.1	12.6	9.9	39.1	29.9
Burkina Faso	42.1	98.1	13.8	12.2	15.8	11.5	9.8	15.0	9.0	39.1	30.0
Cape Verde	15.8	19.3	15.2	10.0	12.2	9.7	10.7	15.5	8.9	100	100
Côte d'Ivoire	11.1	14.9	8.5	12.2	15.8	11.6	7.2	11.2	6.6	33.3	23.3
Gambia	102.8	104.6	60.5							13.7	0.7
Ghana	92.5	97.1	39.7							14.3	1.3
Guinea	20.1	39.7	10.1							38.7	29.5
Guinea-Bissau	48.7	40.1	50.0	11.9	14.6	11.5				97.7	97.4
Liberia	26.7	23.8	27.2	10.2	10.6	10.1				100	100
Mali	28.5	59.2	13.4	12.2	15.8	11.5				39.9	30.9
Mauritania	19.8	38.1	10.6	12.0	11.1	12.2	8.1	6.6	8.3	39.3	30.1
Niger	44.7	85.7	38.2	12.2	15.8	11.5	11.3	14.8	10.1	96.7	96.2
Nigeria	118.3	150.0	49.2	12.1	15.8	11.4	10.7	10.3	10.7	19.1	7.0
Senegal	30.0	29.8	30.0	12.2	15.8	11.5	9.4	12.9	8.4	100	100
Sierra Leone	47.4	40.4	48.5							100	100
Togo	80.0	80.0	80.0	12.2	15.8	11.5	11.1	16.3	10.4	13.9	0.9
South Africa	19.0	40.4	15.7	7.6	8.5	7.5	5.7	10.5	5.3	96.1	95.5
Brazil	31.4	35.4	30.8	13.5	10.0	14.1	9.9	12.5	9.8	100	100
China	10.0	15.7	9.2	9.9	15.6	9.0	4.5	9.2	4.2	100	100
USA	3.5	4.8	3.3	3.5	5.2	3.2	2.2	3.8	2.1	100	100
European Union	4.8	10.9	3.9	5.1	10.7	4.2	2.7	8.5	2.3	100	100

Tariff classification category	ECOWAS ⁵	WAEMU
Basic social products	0.0	0.0
to be continued		
conclusion		
Basic products, raw materials and capital goods	5.0	5.0
Semifinished goods and inputs (intermediaries)	10.0	10.0
Final goods	20.0	20.0
specific goods for economic development	35.0	-

¹ Tariff band assumed in the World Trade Organization (WTO).

² Most Favored Nations (MFN) tariffs are the standard tariffs charged for imports from WTO member nations, do not include preferential tariffs and the lowest tariffs set within import quotas.

³ Effective tariffs applied, weighted by the traded volumes of the products, 2014.

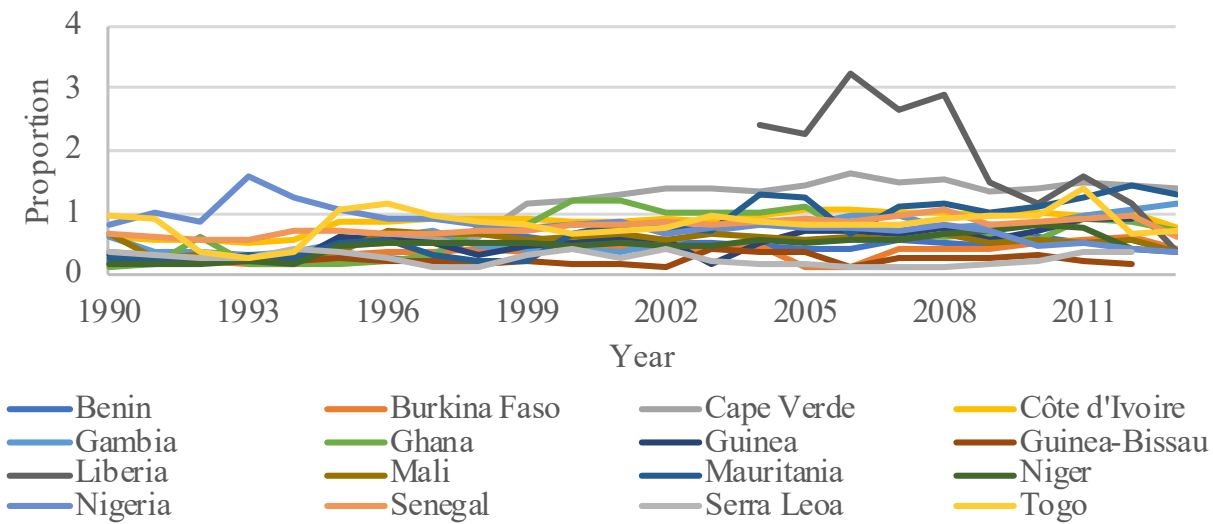
⁴ Percentage of products or tariff lines (products defined at a highly detailed level for the fixing of import taxes) in the country's legally assumed WTO commitments.

⁵ The definition of product categories in ECOWAS and WAEMU common external tariffs is based on the needs of the products for the countries, the use purpose and the contribution to development.

Tot = Total, Ag = Agricultural e NAg = Non Agricultural.

Sources: WTO, 2016, DGIZ, 2014 and ECOWAS 2010.

Fig. A.1. Evolution of the economic openness $[(X + M) / Y]$ of West African countries, real rates at 2013 prices, from 1990 through 2013.



Sources: WTO and WB, 2015.