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Trade flows between the West African Economic and Monetary Union's members so little: does exports structure matter ?

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Abstract

The West African Economic and Monetary Union (WAEMU) is a regional trade agreement in West Africa. It has registered a quite good improving growth dynamic since its establishment in 1994. But the trade between members remains very low. Many factors have been raised in the literature on this issue without testing the effect of exports similarity empirically. This paper looks at the relationship between exports structure, and the trade flows between member countries. It also investigates which country gain from creating this regional economic agreement in terms of intra trade expanding. The results reveal that country members' goods exported in WAEMU are similar and exports within member countries decrease significantly with the degree of exports similarity. So, exports similarity is also an obstacle to expanding trade between WAEMU members. Also, all member countries don't gain from the trade creation effect generated by WAEMU because of the level of exports similarity. Only Mali increases its exports towards WAEMU member states, but this result relies on the large share of re-export.

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1. Introduction

Regional trade agreements (RTAs) into a Regional Economic Community (REC) are among strategies to increase trade flows between members whatever their level of development (Amr, 2013). This idea refers to the trade creation effect led by reducing tariffs on trade between countries (Viner, 1950; Hasson, 1962). Since its establishment in 1994, trade flows between the West African Economic and Monetary Union (WAEMU) members remain very low. Exports within members stagnate on average around 14% of total exports from 1996 to 2013. While in the European Union (EU) and the North American Free Trade Agreement (NAFTA) exports between members record respectively over 60% and 49% on the same period (UNCTAD, 2016).

Several studies look at this issue about the WAEMU and more generally about Africa where trade flows between members remain very low. Many obstacles have been pointed out both on the economic and the political sides. On the economic side, authors show that: the exchange rate management, the insufficient of infrastructure, a low product differentiation, the high transaction costs, a narrow domestic markets and a lack of political commitment (Sekkat and Varoudakis, 2000; Longo and Sekkat, 2004; Yang and Gupta, 2007; Francoisa and Manchin, 2013; Fé, 2019) are crucial to explaining the low level of trade flows between countries in Africa. On the political side, the literature focuses on questions of the sovereignty (Sylla, 2003), the political tension (Longo & Sekkat, 2004), the institution quality and the good governance (Levchenko, 2007; Francoisa and Manchin, 2013) to explain this low level of trade flows. Nevertheless, to our knowledge, there is not any empirical analysis that put a look on the issue of the role played by trade structure. In his paper, we assume that the level of exports' similarity might be a weakness for expanding trade between countries in Africa in general and in WAEMU, particularly without any sufficient complementarity. To what extend products exported by WAEMU members are similar? And does the level of the similarity stand as an obstacle to expanding trade flows between members? What is the trend of exports within WAEMU members countries considering the level of exports similarity over the years? Previous studies address the issue of exports similarity as a hypothesis for low intra-regional trade without testing it. This analysis's contribution is to give an empirical test of the similarity hypothesis in the West African Economic and Monetary Union case. The study also provides a country-by-country assessment to test the “representative demand” and “product differentiation” theories explaining intra-regional trade intensity.

We use a simple approach to compute the similarity index (Finger and Kreinin, 1979). This index is then plugged as an explanatory variable in an extended gravity model to estimate the effect of the export similarity on the trade between WAEMU countries. The results reveal that the export structure of the WAEMU members countries is quite similar. Exports between member countries decrease with the degree of the similarity of trade basket. A 100% increase in this index leads to a decrease in exports value on the WAEMU market, about 0.9%. We also find that; all member countries don't benefit from the trade creation effect generated by WAEMU in the presence of exports similarity. Only Mali increases its exports towards WAEMU member states, but this result relies on the large share of re-export towards the

WAEMU market. Burkina Faso, Guinea Bissau and Niger see their exports decreasing with the degree of similarity.

The rest of the paper is organised into three sections. The first revisits the literature review by giving theoretical and empirical findings on the effect of product similarity on trade flows. The second section presents the methodology. Results are discussed in the last section before concluding.

2. Literature review

2.1. Theoretical and conceptual framework

Exports similarity between two countries can be defined as the correspondence of their export structure. The export structure of country A and B will be similar if products into the exports basket of both countries refer to identical product categories. Two theoretical conceptions are opposed in international trade theory when explaining the effect of the export similarity on trade flows between two countries: traditional and new theories.

According to traditional theories, the difference in technology (Ricardian theory) and the factorial abundance difference (HOS theory), countries benefit from trade openness if they are specialised in producing goods for which they have a comparative advantage. And the good sold by each country is different. The Ricardian theory (and its extension Heckscher Ohlin Samuelson) has been the basis of international trade theory. It is, however, not able to account for the reality of trade. His hypotheses lead him to exclude from the analysis of multinational firms' strategy and the existence of intra-industry trade. Thus, according to these traditional theories, one of the central hypotheses is the non-similarity of traded goods to ensure that international trade is profitable for all countries (Feenstra, 2015).

As far as it concerns new theories, despite the similarity of production structures and traded goods, this is not an obstacle to expanding trade between partners. What explains trade flows in this case? New theories highlight at least two elements: the representative demand and product differentiation. Concerning the representative demand approach, the conditions of production within a country depending on the conditions of demand. Indeed, at first, sales prospects are primarily national. Producers will, therefore produce goods corresponding to those sought by the local population. The foreign market is then only an extension of the domestic market. More countries are similar, more the range of exportable goods is identical to the range of importable. Trade is, therefore between on the same wavelength countries and involves close-knit products seeking new outlets in foreign markets where demand for this type of product already exists. Competition between companies will therefore push them to establish themselves simultaneously in the area of competitors, leading to the emergence of intra-industry trade (Hasson, 1962). Linder's theory improved the Heckscher-Ohlin theory because it specified that trade would occur between countries, even if the proportions of the factors were identical, provided that their demand preferences were similar. In Linder's view, a country will largely export its products towards countries with identical demand patterns and income levels. He calls this the "similarity of preference". Due to the similarity of preferences, the country will have overlapping demands (Viciu and al, 2016).

For the product differentiation approach, the idea developed here is, products of the same branch are not identical. They are heterogeneous in their characteristics, even if their utility is the same. Products could differ in their colour, packaging, advertising, marketing, image, and proposed after-sales service. According to Lassudrie-Duchêne (Guillochon et al., 2016; Krugman et al., 2018), consumer demand is a demand for a difference in similarity: agents

demand a set of characteristics. However, products of the same branch differ in the characteristics offered. Therefore, a French consumer who wants to buy a car may be attracted by a German car because this car's characteristics will better meet his needs than those of French cars.

On the contrary, German consumers will be attracted by French cars. The expansion of intra-industry trade would then come from the heterogeneity of products within the same sector. Differences in prices and production costs cannot explain trade flows, but by the differentiation of the products and strategic policies of research, quality, marketing and advertising. Structural competitiveness then supplants price competitiveness.

The demand approach shows that while goods are similar, trade between partners is possible. This approach explains the existence of intra-industry trade (similar products). It emphasises the impact of demand as a source of international trade. Therefore, trade is between like-minded countries and involves close-knit products seeking new outlets in external markets where demand for this type of product already exists. Competition between firms will, therefore push them to establish themselves simultaneously on the territory of competitors. This movement will lead to the emergence of intra-industry trade.

Finally, from a theoretical perspective, the exports structure's similarity is not fundamentally a brake on expanding trade flows. A good similarity of exports can lead to intra-industry trade growth and increase trade flows between countries.

2.2. Empirical literature review

As an extension of the theoretical literature, empirical works have examined the effects of exported goods' similarity on trade dynamics. Analysing the effects of export structure similarity on trade raises the following question: Does the similarity of the external trade structure's content is creative of trade within partners? In this regard, the literature presents two opinions. The first argues that the similarity of exports is trade-creating. As for the second, it leads to a contrary result.

Venables (1999) shows that the similarity of supply factors and weak demand generally helps more trade diversion effects than trade creation effects mostly within a Regional Economic Community (REC) gathering developing countries. However, relatively more developed countries in this REC benefit from trade integration effect (a trade creation effect) to the least developed countries' detriment. In the West African Economic and Monetary Union (WAEMU) case, Senegal has earlier benefited from regional integration to increase its trade with other member countries (Diaw and Tran, 2009). This result would mean that Senegal's similarity of products within WAEMU is not a handicap to increase trade with other members countries. Considering the similarity of the productive structure or exports, they conclude that similarity could positively impact the trade within the member countries of the Association of South-East Asian Nations (see Dinka and Kennes (2007) cited by Nouwoue, 2013).

But, Yeats (1998, 1999), Schiff, (1997) and Cadot and al, (2000) show that developing countries are not willing to trade with each other in the same Regional Economic Community (REC) because of the similarity of the tradable goods. Of course, it could be an increase in trade between developing countries, but, this would be detrimental to more efficient and competitive third countries outside the integration area. This result is in line with Venables (1999). More generally, empirical studies based on comparative advantages suggest that the overall effect of South-South agreements depends among other things on the characteristics of the partners, their degree of mutual economic dependence, the initial costs of their trade (particularly MFN tariff

level) and their degree of complementarity in terms of supply structure (UNCTAD, 2007). Going in the same direction, Bye (1997) and Boungou (2004) cited by Nouwoue, (2013) affirmed that productive complementarity favours specialisation and trade between member states of the same REC. Therefore, we might think that the decomposition of value chains at the sub-regional level, implying a complementarity of production structures, is a trade growth source between countries belonging to the same regional economic community. This issue is not the similarity of products, but the effects of specialisation based on each country's comparative advantages, which would be the trade flows' driving force.

Following Linder's model (1961)[2], Viciu and al (2016) identify other factors that could affect developing countries trade performance in Romania. Their results show that there are other creative forces of trade flows apart from the similarity of incomes and markets. These are the political and economic restrictions and opportunities generated by foreign relations in the region. Exports structure similarity is indeed a source of growth in expanding trade in an area. More importantly, the trade intensification between the two countries depends on trade policies and the political and economic environment. Authors like Mayda and Steinberg (2009) point out that one of the conditions for trade creation in a regional economic community is the strong adequacy between supply and demand. For them, the supply of some would have to meet the expectations of others.

For the positive effects of export structure similarity (or trade flows between countries) to strengthen regional economic integration gathering developing countries, preconditions must be fulfilled following the literature. This empirical literature mentions some factors as obstacles to expanding trade between developing countries. Among these factors there is the institutional environment (Francoisa and Manchin, 2007), the quality of economic infrastructures and the mismanagement of economic policies (Coe, Helpman, and Hoffmaister, 1997; Rose, 2000; Longo and Sekkat, 2004, Francoisa and Manchin, 2007; Anderson & Yotov, 2016), changes (Bangake and Eggoh, 2008), political instability (Longo and Sekkat, 2004) and unadapted trade policy, as well as low GDP (Rodrik, 1997), are all factors that have been identified in the literature. However, Geda and Seid, (2015) examining intra-African trade and prospects for promoting regional economic integration through this trade, show that there is significant potential for intra-African trade as a catalyst for regional integration. But, in his view, the realisation of this potential and the effort to advance regional integration through intra-African trade is hampered by the lack of complementarity of exports and imports and the relative competitive position of potential suppliers.

In the case of WAEMU, among other factors, the empirical literature denotes the importance of cross-border trade (Agbodji, 2007), the intra-regional disparity in the levels of rail, road and telephone infrastructure (Geourjon et al., 2013; Fé, 2019). We can also highlight the Economic Community of Central African States (ECCAS) another REC in sub-Saharan Africa. In ECCAS, the increase in intra-trade would have been greater if the rationalisation process were effective and if countries had implemented the necessary reforms to promote market integration by strengthening infrastructure and better institutions quality (Avom and Mignamissi, 2017). Nouwoue (2013) shows that the similarities of exports have a negative and significant influence on bilateral trade within ECCAS. So the similarity of exports is a brake on the expansion of trade between this regional economic community members. Nouwoue (2013) does not give a country-by-country estimation to allow us to investigation carefully how this similarity works in details.

Finally, several factors limit the expansion of trade between members of a REC in Africa in general and in WAEMU, particularly. Previous papers did not address this issue, including the degree of similarity of the products traded. However, trade facilitation can be beneficial in some

member countries, those primarily involved in value chains as suppliers (Hoekmana and Shepherd, 2015) or those more economically advanced in RECs grouping low-income countries like Côte d'Ivoire and Senegal in the WAEMU (Venables, 1999). This analysis draws on all of this literature and attempts to assess the effect of the similarity of exports structure on Intra-WAEMU trade.

3. Methodology

3.1. Econometric specification

We use an extended gravity equation. The equation (1) gives the original specification :

$$Export_{ij,t} = A\frac{{GDP_{it}}^{\theta}{GDP_{jt}}^{\vartheta}}{D_{ij}^{\mu}}e^{\gamma X_{ijt}} \qquad 1$$

where i stands for the exporting country, j the partner country, and t the time. A is a scale parameter. $Export_{ij,t}$ is the bilateral exports value from a country (i) to a country (j) at time t. GDP_{it} and GDP_{jt}, D_{ij} and X_{ijt} represent respectively the Gross Domestic Product of the country (i) and the country (j), the distance between country (i) and (j) and a set of control variables (see Table 1 for more details about the variables). We suppose that the trade similarity index is part of control variable assuming that, a greater similarity index would be favourable to Intra trade in connection with the assumptions of Linder's theory based on "preference similarity". This index $EIS_{ij,t}$ is based on Finger and Kreinin (1979). The following formula is:

$$EIS_{ij} = 100 * \sum_k min\left\{\frac{Exports_{ik}}{\sum_k Exports_{ik}}; \frac{Exports_{jk}}{\sum_k Exports_{jk}}\right\} \qquad 2$$

The factor $\frac{Exports_{ik}}{\sum_k Exports_{ik}}$ is the share of product k in the total exports of the country (i). When $EIS_{ij} = 0$, that means there is no similarity between the exports structure of countries i and j on the reference market. On the other hand, when $EIS_{ij} = 100$, there is a perfect similarity between the export supply structures of countries i and j on the reference market. The reference market is WAEMU market. It is a simple index (Kellman and Schroder, 1983; Linnemann and Van Beers, 1988), and it compares the distribution of the countries' export supply on the WAEMU home market. We use (three digits) data by-product of member countries from the UNCTAD[3]database according to the Standard International Trade Classification Revision 3[4] (the current standard international classification (CTCI) revision 3). The CTCI is a product classification nomenclature proposed by the United Nations Statistical Commission and is used for foreign trade statistics (values and volumes of exports and imports of goods). It allows international comparisons of commodities and manufactured goods.

The final structural gravity specification, using the multiplicative approach following Santos-Silva & Tenreyro, (2006) is as follow:

$$T_{ij,t} = exp\left[\beta_0 + \pi_{i,t} + \beta_E \ln(GDP_{it}) + \beta_Y \ln\left(GDP_{jt}\right) + \beta_{DIST} \ln\left(D_{ij}\right) + \beta_{SEA} SEA_{ij} + \beta_{EIS} EIS_{ijt} + \beta_{CNTG} CNTG_{ij} + \mu_{ij}\right] \times \varepsilon_{ijt} \qquad 3$$

where ε_{ijt}, the error term and μ_{ij} the error term due to the country pairs. $CNTG_{ij}$ is an indicator variable capturing the presence of contiguous borders between trading partners, and SEA_{ij} is a dummy variable that takes value 1 if both partners have a sea border and 0 if not.

The term $\pi_{i,t}$ denotes the set of time-varying exporter-country dummies, which control for the outward multilateral resistances. Following Olivero and Yotov, (2012) the multilateral

resistance terms are accounted for by exporter-time and importer-time fixed effects in the gravity estimation. Then country Pairs fixed effects are included to account for the endogeneity of trade policy variables (Baier and Bergstrand, 2007).

3.2. Data source

We use annual data from 1996 to 2013 for the eight WAEMU members' countries. See Table 1 for a brief description of each variable.

Table 1: Data description

Variables	Sources	Units
Bilateral Exports within WAEMU members states (value)	International Monetary Fund, *Direction Of Trade Statistics*	USD (units)
Gross Domestic product (i) (value)	UNCTAD	Millions of USD, current price, current exchange rate
Gross Domestic Product (j) (value)	UNCTAD	Millions of USD, current price, current exchange rate
Distances	CEPII	km
Exports Similarity index (EIS)	Author calculation EIS	

Source: Author

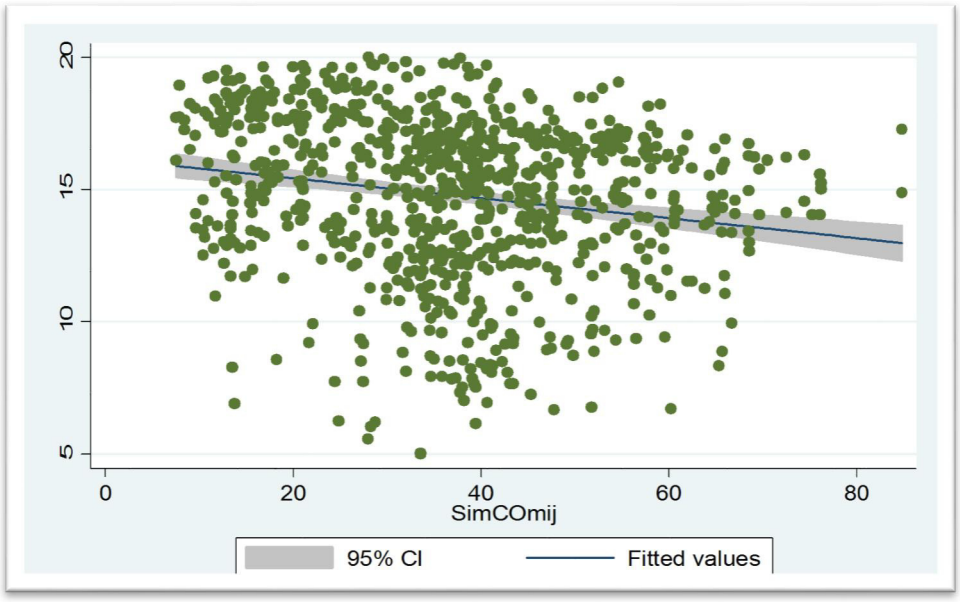
About the export similarity index, the expected sign is negative to corroborate the weakness of intra-African trade. This sign would translate well because the exports' similarity is an obstacle for expanding Intra- WAEMU trade, thus reinforcing the commercial integration.

4. Results

4.1. Some descriptive statistics

The relationship between the similarity index and exports flows (*graph 1*) shows a downward trend. So, exports similarity index is negatively correlated with trade flows. This idea assumes that the countries' level of similarity would be an obstacle to expanding trade with WAEMU.

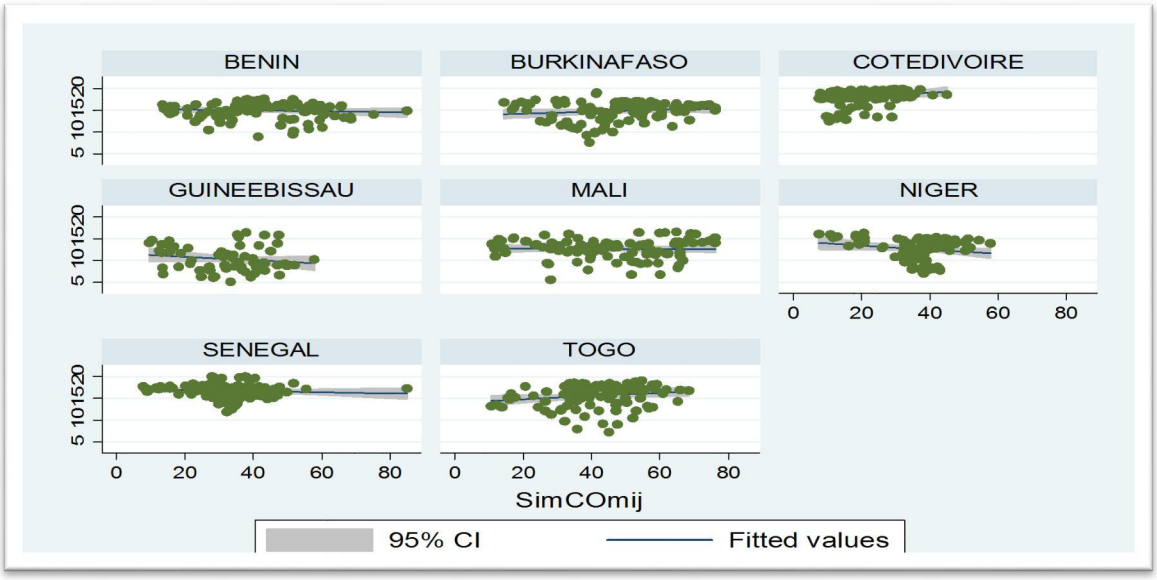
Graph 1: Relationship between Intra WAEMU exports and the indicator of similarity of exports



Source: The author

But analysing each member country's performance, it appears that Burkina Faso, Côte d'Ivoire, Mali and Togo derive a positive relationship between Intra-WAEMU exports and the exports similarity index over the period (*Graph 2*). In these countries, trade similarity index goes with an increase in intra trade. This result is not the case for the remaining four countries which present a downward trend. This would mean that these countries' exports structure is not conducive to the regional market's trade expansion.

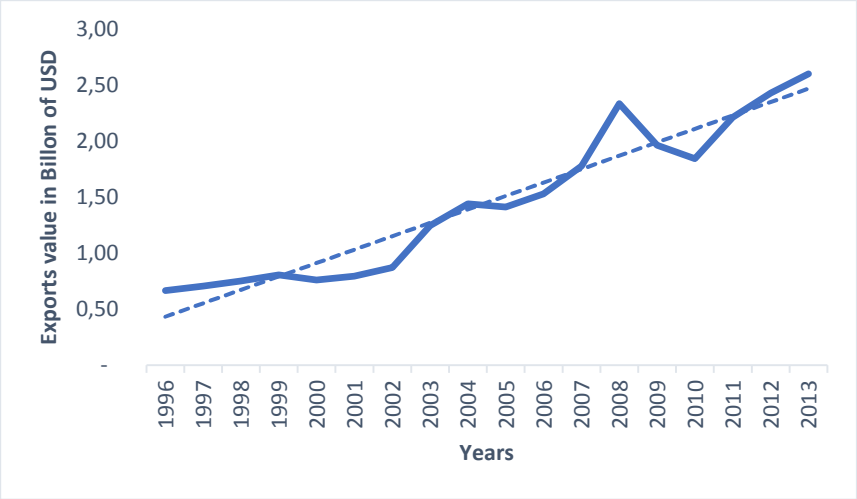
Graph 2: Relationship between Intra WAEMU exports and the indicator of similarity of exports for each country



Source: The author

Intra-WAEMU exports increased (see *Graph 3*), from 0.6 billion CFA francs in 1996 to just over 2.6 billion CFA francs in 2013. This trend represents a rise annual average of about 8.5% per year from 1996 to 2013. Trade between member countries has increased since the creation of WAEMU in 1994 even if it remains relatively low (between 14% and 15%, (UNCTAD, (2016).

Graph 3: Evolution of Intra-UEMOA exports between 1996 and 2013



Source: The author

4.2. Estimation method, robustness check, results and discussions

4.2.1. Estimation method and robustness check

Analysis of exported values shows a high proportion of zero values. Given this high proportion of zero values, equation (3) is estimated using a pseudo-maximum likelihood Poisson model (PPML) (Santos-Silva and Tenreyro, 2006, 2011). This estimator has two advantages: it corrects the zero-valued data's truncation and the potential bias generated by the gravity model's log-linearisation.

We assume that the process that generates this high proportion of zero values is different from the process that generates the positive values of exports. Indeed, we could argue that the zero export flows can be explained by the low income or the lack of suitable conditions to generate Intra WAEMU exports for economic reasons. For example, the mismatch between the exportable supply and the WAEMU member's demand or the substitution effects between a partner outside WAEMU offers the same products at more competitive costs. To check the robustness of the result, equation (3) is also estimated using two other techniques that suit with a high proportion of zeros in the dependent variable: Zero-Inflated Poisson and Zero-Negative Binomial (**Appendix 1**).

4.2.2. Results and discussion

It appears that the GDP of the exporting country and the importing country have a positive impact on exports in the WAEMU (Table 2). The coefficients of these two variables are positive and significant. An increase in GDP in the exporting country of 1% leads to a 1.064% increase

in Intra WAEMU exports. A 1% increase in the WAEMU importing member country's GDP leads to a 0.37% increase in Intra WAEMU exports.

Countries sharing a common border export a lot within WAEMU. Results show that when countries have a common border, they export 3.79 times more than those with no common border. The geographical proximity of two trading partners has a significant impact on trade in WAEMU. It facilitates access to countries' domestic markets and reduces transportation costs. At the same time, considering Agbodji, (2007), the importance of these cross-border mismatches limits Intra WAEMU trade. Countries opened on the sea, export 10.12 times more to the WAEMU market compared to other countries. Countries with a seaboard export more than the other do.

Table 2 : Estimations results

Estimation Methods	Poisson Pseudo-Maximum de Vraisemblance (PPML)
Dependent Variables	Exports
ln(GDP exporting country)	1.064***
	(0.042)
ln(GDP importing country)	0.369***
	(0.043)
ln(Distance)	-0.075
	(0.103)
Contiguity	1.333***
	(0.118)
Sea	2.315***
	(0.192)
Exports similarity index (ij)	-0.009***
	(0.003)
Constant	2.756***
	(0.951)
Pseudo log-likelihood:	-8.387e+09
Observations	1,008
R-squared	0.740

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: The author

The similarity index has a negative and significant impact on intra-Community exports. A 1% increase in exports' similarity index leads to a decline in exports by about 0.009%. Indeed, if the similarity index doubles, Intra-WAEMU exports drop by 0.9%. The effect is undoubtedly small but significant. In the case of the Economic Community of Central Africa States (ECCAS), Nouwoue, (2013) obtained the same result.

Following estimation results at the country level (see Appendix 1), only Mali gains from this RTAs. The coefficient associated with the similarity index for Mali has a positive and significant sign (+0.031). Mali's exports with other members increase during the period. So it benefited from the similarity of its exports with those of the WAEMU countries. Mali's exports are related to goods that are in relatively high demand by member countries. The WAEMU home market is a good extension of the domestic market of Mali.

At the product level, Mali's exports to the WAEMU market mainly concern the following products: Petroleum oils or bituminous minerals> 70% (42.06%), Lime, manufactured building materials (except clay, glass) (21.77%) and Food products and preparations (4.43%). These products represent 68.26% of the total export in the WAEMU market. Knowing that Mali is not an oil producer and Petroleum oils or bituminous minerals represents more than 40% of total exports, still, re-export could explain this result.

But for Burkina Faso, Guinea Bissau and Niger, the coefficient is negative, respectively (-0,046), (-0,124) and (-0,045). So for these countries, the WAEMU market is not an extension of their domestic market.

We also find two results for the country-by-country analyses that catch our attention (see **Appendix 2**): the negative coefficient for the logarithm of GDP exporters for Côte d'Ivoire and Niger, the negative coefficient for the logarithm of GDP importers for Guinea-Bissau.

Two competing forces influence trade intensity between countries: attraction forces (income and size of countries) and resistance forces (distance and other trade barriers). Côte d'Ivoire and Niger's results show that GDP is not a force of attraction for intra-WAEMU trade for these countries. The more Côte d'Ivoire and Niger produce, the less they export to the regional market. This situation could be explained on the one hand by the existence of misappropriated trade flows and on the other hand by the mismatch between the additional supply of products resulting from economic growth in these countries and the sub-regional demand for products.

This result could be explained by this economy's potential in terms of exportable goods about the negative coefficient associated with the logarithm of the GPD of importers in Guinea Bissau's estimate. Indeed, Guinea Bissau is a small, poor and very undiversified economy with a population of just over 1.8 million. The economy is based on agriculture and fishing. The exportable potential is limited or saturated. Therefore Guinea Bissau cannot offer new consumption opportunities to importers with additional income, hence the negative sign.

5. Conclusions and recommendations

This paper analyses the effect of exports similarity on trade flows in the West African Economic and Monetary Union (WAEMU). We use a simple approach to compute the similarity index following Finger and Kreinin (1979). This index is then used as an explanatory variable in an extended gravity model to estimate its effect on trade flows between WAEMU countries. The results reveal that the export structure of the WAEMU members countries is quite similar. Exports between member countries decrease with the degree of the similarity of trade basket. A 100% increase in the similarity index leads to a decrease in exports value about 0.9%. We find that all member countries don't benefit from the trade creation effect generated by WAEMU in the presence of exports similarity. Only Mali increases its exports towards WAEMU member states, but this result relies on the large share of re-export. Burkina Faso, Guinea Bissau and Niger see their exports decreasing with the degree of similarity.

Burkina Faso, Guinea Bissau and Niger see their exports decreasing with the degree of similarity. In other words, the sub-regional market is not an extension of the domestic market of these countries. For the remaining countries (Benin, Côte d'Ivoire, Senegal and Togo) the effect is not significant.

This analysis calls for all reflections on the problem of strengthening regional economic integration in WAEMU. Thus, this export structure could be a catalyst to foster trade integration as far as RTAs in developing area are concerned. To do so, the following policies could be implemented in WAEMU:

Create the necessary conditions for the internationalisation of production systems in WAEMU: the internationalisation of production systems, which rely more and more on vertical structures of exchange encompassing several countries, each of which specialises in a particular stage production, participate in the development of world trade and could strengthen regional integration. Countries will thus specialise in process segments earlier than final goods.

Adapt the WAEMU supply to member countries' needs as a result in Mali: the increase of wealth in space will lead to the creation of new needs. The maintenance of the exportable potential in WAEMU will require an adjustment of economic agents' offer in the union. This will go through the definition and updating of an industrial policy oriented towards exploiting new opportunities.

Endnotes

[2] (i) The country's potential trade is confined to these goods that have domestic demand.
(ii) Two trading countries are engaged in the trade of such goods the demand for which exists within their domestic markets.
(iii) The domestic demand for goods is determined by the level of per capita income.
(iv) Broadly, similar levels of income influence the potential trade between the two countries.

[3] http://unctadstat.unctad.org/FR/Classifications.html

[4] CTCI revision 3: We considered product groups according to the CTCI revision 3 classification codes. The product group identifier has 3 digits, and data covers all the 9 sections. The main sections are:

- Section 0: Food,
- Section 1: Drinks and Tobacco,
- Section 2: Inedible Raw Materials, Non-Including Fuels
- Section 3: Mineral fuels, lubricants and related products,
- Section 4: Oils, greases and waxes of animal or vegetable origin,
- Section 5: Chemicals and Related Products,
- Section 6: Manufactured goods classified primarily by raw material,
- Section 7: Machinery and transportation equipment,
- Section 8: Miscellaneous Manufactured Items
- Section 9 Articles and transactions not classified elsewhere in the CTCI

[5]Pseudo-maximum likelihood Poisson model

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Appendices

Appendix 1: *Table A 1: Estimations results robustness for robustness check*

Estimation Methods	Zero-inflated Poisson	Zero-inflated Binomial Poisson
Dependent Variables	Exportations	Exportations
ln(GDP exporting country)	1.038***	1.065***
	(0.042)	(0.061)
ln(GDP importing country)	0.353***	0.362***
	(0.044)	(0.065)
ln(Distance between mains cities)	-1.054***	-0.656***
	(0.103)	(0.130)
Contiguity	1.324***	1.222***
	(0.117)	(0.149)
Sea	2.277***	2.072***
	(0.192)	(0.119)
Exports similarity index (ij)	-0.008***	-0.014***
	(0.003)	(0.003)
Constant	3.030***	7.249***
	(0.944)	(1.129)
inflate		
GDP exporting country	-0.971***	-0.975***
	(0.101)	(0.098)
Constant	5.884***	5.906***
	(0.776)	(0.757)
/lnalpha		0.711***
		(0.040)
Wald (Chi2)	2213.90	
Pr > Chi2	0.0000	
LR (Chi2)		733.90
Pr > Chi2		0.0000
Log-likelihood		-14961.19
Pseudo-log-likelihood:		
Observations	*1,008*	*1,008*
R-squared		
Robust standard errors in parentheses pour le PPML		
**** p<0.01, ** p<0.05, * p<0.1*		
Vuong test of zinb vs. standard negative binomial: z = 21.21 Pr>z = 0.0000		

Source: The author

Appendix 2: *Table A 2:* ***Estimation results for each country.***

Estimation Method	PPML							
Pays	Benin	Burkina Faso	Cote d'Ivoire	Guinea Bissau	Mali	Niger	Senegal	Togo
Variables dependants	Exports							
ln(GDP exporter)	1.380***	1.205***	-0.886***	6.730***	0.718**	-1.598***	0.613***	1.702***
	(0.183)	(0.383)	(0.173)	(1.254)	(0.347)	(0.390)	(0.136)	(0.274)
ln(GDP Importers)	0.399***	-0.792	1.126***	-2.438***	0.709***	1.276***	0.839***	0.274**
	(0.099)	(0.496)	(0.083)	(0.533)	(0.246)	(0.306)	(0.073)	(0.112)
ln(Distance)	0.162	0.510	-1.476***	-0.027	-2.575***	-0.253	-0.027	-0.173
	(0.130)	(0.460)	(0.188)	(0.788)	(0.498)	(0.269)	(0.178)	(0.114)
Contiguity	1.442***	5.597***	0.215**	-0.475	1.279***	1.677***	2.386***	1.191***
	(0.288)	(1.488)	(0.103)	(1.177)	(0.398)	(0.430)	(0.154)	(0.253)
Exports similarity index (ij)	*-0.830*	*-0.046***	*0.006*	*-0.124****	*0.031****	*-0.045****	*0.008*	*0.001*
	(1.758)	(0.022)	(0.005)	(0.031)	(0.007)	(0.013)	(0.006)	(0.006)
Constant		6.056**	27.569***	-5.657	16.455***	18.154***	3.767**	1.789
		(2.888)	(1.984)	(7.521)	(3.798)	(3.020)	(1.707)	(1.688)
Observations	126	126	126	126	126	126	126	126
R-squared	0.547	0.205	0.861	0.625	0.746	0.629	0.935	0.682
Robust standard errors in parentheses								
**** p<0.01, ** p<0.05, * p<0.1*								

Source: The author