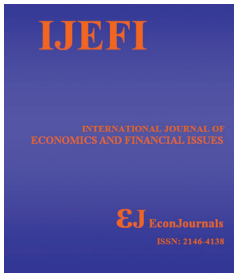

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Impact of the African Continental Free Trade Agreement (ALECA) on Exports

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ABSTRACT

The objective of this article was to measure the impact of trade liberalization on intra-African trade in general and in particular on trade between WAEMU countries and Africa. The use of ex-ante evaluation indicators made it possible to highlight the tendency of African and UEMOA countries to trade with one another. The analysis of these indicators has also highlighted the low diversification and high concentration of exports on commodities but also the introversion of trade of African countries and those of UEMOA. To quantify the impact of trade liberalization on African countries and UEMOA, the structural gravity model of Anderson and Van Wincoop (2003) is used for trade analysis because data are widely available. The estimation of the model by Heckman (1979) method allowed us to show that when the tariffs imposed on the export of commodities are low, they encourage exports and make the goods available to foreign consumers. Restrictions on cross-border investment can limit both inflows and outflows, reducing markets and growth and export opportunities. A restriction of capital movements through the exchange rate contributes to the decline in exports. The free movement of populations leads to an increase in exports.

Keywords: Exchange, Gravity, Exportation
JEL Classifications: E, F, F1, F2, F3, F4

1. INTRODUCTION

The purpose of this article is to study the impact of the liberalization of trade between African countries on the exports of the member countries. The signing of the African Continental Free Trade Agreement (ACFTA) in 2017 is an important step forward in African economic integration. From the point of view of the number of participating countries, it will be the largest free trade area in the world since the creation of the World Trade Organization (WTO). The ACFTA is a trade agreement between 44 African Union member states, aimed at creating a single market followed by free movement and a single monetary union. Beyond the political and institutional agreements, member countries of ACFTA expect an increase in exports while the theory remains silent on the distribution of wealth. What is important to note here is that within ACFTA, there may be significant revenue losses (zero-sum game) in less open countries with industries in sectors of the economy with a comparative disadvantage compared to his peers in other payers members. Nevertheless, despite this significant advance on the continental front, it also raises a lot of questions as to its impact on the exports of the member countries.

Viewed from the perspective of the theory of comparative advantage, the results of this agreement should therefore reduce the obstacles to exchange so that inter-regional trade can develop through specialization, the division of labor and, especially, to comparative advantage.

The theory of comparative advantage (Ricardo, 1815) argues that in an unrestricted (equilibrium) market, each source of production will tend to specialize in the activity where it has a comparative advantage (rather than absolute). The theory holds that the net result will be an increase in income and, ultimately, wealth and well-being for members of the Free Trade Area.

Since the pioneering work of Viner (1950), many authors have contributed to the theory of Free Trade Agreements (FTAs) Vinerian's analysis is now part of a broader theory called the general theory of the second best equilibrium developed by Lipsey and Lancaster (1956). This theory holds that, given a distorted economic system, the elimination of a set of distortions does not guarantee an improvement in overall economic well-being as long as the other economic distortions remain unchanged.

In the context of free trade, this theory implies that reducing tariffs on a discriminatory basis may not improve the well-being of individual countries or the world economy because some tariffs are maintained. The contribution of this paper goes beyond simple gravity models and adopts the Wincott model (2003) to capture the dynamic regulatory complexity of variables relating to tariff barriers and bilateral exchange. The main advantage of the augmented gravity model is that it takes into account the valuation of an FTA by controlling for the effects of other determinants of trade between free-trade countries.

This article is organized as follows: Section I: The literature review, Section II: The data used for this work Section III: An ex-ante analysis of free trade areas with a focus on African experiences on impact trade liberalization on trade among member countries; Section IV: Dedicated to the econometric framework; Section V: Estimation and interpretation of results; Section VI: The conclusion.

2. THEORETICAL AND EMPIRICAL REVIEW OF THE LITERATURE

On the theoretical side, the analysis of the impacts of free trade requires a clear and precise understanding of the effects that an FTA may have before its negotiation (ex-ante evaluation) is necessary for better overall decision-making in the negotiations with the member countries. This is all the more important in terms of overall costs and benefits as well as identifying what the country can and cannot provide to its partners.

In the literature, the pioneering model for analyzing the impact of FTAs is Viner (1950). Its model remains important as an analytical and theoretical framework, as it defines the conditions that determine when an FTA will be harmful or favorable in relation to trade creation and trade diversion. However, the Viner model has undergone several extensions following the formulation of three hypotheses namely: The proximity of the import source outside the free trade area, the assumption that the country of origin imposes a non-discriminatory tariff before the FTA, and finally if the importing country is small economically and the supply of each foreign exporter is at a single price. In the first case, it would be easy to show that the FTA would only have a trade-creating effect on imports from that country before and after the FTA. Therefore, the theoretical framework for the economic analysis of free trade agreements should not be a trade diversion. Thus, the FTA would benefit the countries of origin. In the second case, if, prior to the free trade agreement, the country of origin imposed different duty rates on imports from different sources, there could be three results depending on the relative prices of the partner's tariffs: (i) If the price of the partner, including the fare, was lower than the price of the foreigner, including the fare, then there would be trade creation; (ii) if the price of the partner was higher than the inclusive foreign price and, after the FTA and the partner's pre-tax price was still higher than the foreign price, the FTA would have no effect on country of origin; and (iii) if the price of the partner was higher than the inclusive external tariff and, after the FTA, the partner's pre-tax price was lower than the outside price, the FTA would result in both trade creation and the diversion of trade. In the latter case, the model assumes that the importing country is small economically and that the supply of each foreign exporter is at a single price. This hypothesis implies that a country always imports a good from a single country, which moreover is not realistic in the case of a good with several varieties. In addition, the assumption also implies that the terms of trade of the importer do not change with respect to a particular trading partner.

Empirically, several general equilibrium models with exchanges of several multiple properties have been developed. Lipsey (1970) and Wonnacott (1982) consider two properties. They assume that trade is balanced and one country will export one of the goods and import the other. The model takes into account changes in the terms of trade due to import demand and export supply. This is an important aspect of FTAs that is covered in general equilibrium models but is generally missing in Viner's analyzes. To represent the international interaction of markets in the model, the authors use a commercial supply curve. A trade supply curve records the quantity of a good that a country is ready to export to the world market in exchange for a quantity imported from another good, given the terms of trade, which is the relative price of exports to imports.

The main conclusion of this analysis is that a group of small countries can benefit from an FTA rather than unilateral trade liberalization if foreigners have high trade barriers against them or if the group has to bear high transport costs to export to foreign countries. This is an explanation of the formation of FTAs between geographically close countries. Wonnacott and Wonnacott (1981) also point out that countries do not engage in FTAs simply to reduce their own tariffs, they do so to open market access for their partners. If a partner's market access is relatively more valuable than access to external markets, then an FTA produces gains for its members.

For Collier (2008), integration benefits countries with characteristics closer to the global average, while those that depart from it in the case of developed country trade blocs tend to be the poorest. In the case of developing country trading blocs, they tend to be richer in the bloc. These models are useful for estimating the evolution of welfare for the countries belonging to the FTA. However, they are not sufficiently general to account for the variety of commodities traded and trade policies, nor flexible enough in terms of assumptions, and they lack specific formulations. For these reasons, modern quantitative analyzes of the welfare effects of FTAs are based on larger theoretical models in terms of products and trading partners in a general equilibrium framework (Lloyd and Schweinberger, 1988, Grinols and Wong, 1991, Baldwin

and Venables, 1995, Lloyd and Maclaren, 2004, Kowalczyk and Riezman, 2009).

These theoretical models also include many details about the structure of production, consumption and trade in an economy in order to provide very general and rich analyzes of trade policy. They allow the study of several goods, factors and households. In addition, they are valid for production structures with traded intermediate inputs, and specific and non-specific inputs.

Kemp and Wan (1976) formulates a theorem on FTA based on three assumptions: Imports from third countries do not change; the regional agreement includes total internal free trade, thus leading to greater efficiency through the creation of trade, and finally, a clearing mechanism allows all losing countries to be fully compensated. Therefore, Kemp and Wan have shown that in theory, it is always possible to conclude a regional agreement that maintains or improves the welfare of its members, creates a clear improvement for the group and does not harm the rest of the world. Felbermayr and Larch (2013) argue that an FTA could limit the competitiveness of specific sectors in third countries when FTAs lower prices in these sectors (in countries that are party to the FTA) (Chang, 2005) argument that FTAs between an industrialized economy and a developing economy could be detrimental to the developing country, as an FTA restricts a developing country's ability to protect its "infant industries." As a result, FTAs could lead to premature deindustrialization in developing countries.

Although the entire literature on FTAs is broad in terms of the number of studies identified, most do not focus on fully implemented FTAs, which limits the extent to which they can collectively be considered to have built a "body of knowledge." Some have focused on trade liberalization efforts, seeking to reduce or eliminate tariffs (Green et al., 2001, Manasse and Turini, 2001), or by investigating deregulation measures in general (Cragg and Epelbaum, 1996). These measures have certain limitations: First, focusing on tariff barriers excludes non-tariff barriers. Therefore, this approach may neglect protectionist attempts through non-tariff barriers. Secondly, "consistent data on tariffs are not available for many countries and for a sufficient number of years" (Spilimbergo et al., 1999) Third, the reduction or elimination of tariffs is not necessarily followed increased trade flows (exports and/or imports) Lee (2005) argued that the policy of reducing or eliminating tariffs should be checked against actual performance and the possibility of substitution of instruments.

As a result, other authors have emphasized the effects of trade liberalization, such as changes in the relative price of products (Baldwin and Cain, 1997, Desjonqueres, 1999, Hanson and Harrison, 1999, Haskel and Slaughter, 2001, Munshi, 2008); exports and imports to gross domestic product (GDP), or the ratio of trade to GDP (Robbins and Gindlings, 1999, Calderón and Chong, 2001, Morone, 2003, Mosley and Uno, 2007). Studies attempting to test the Heckscher-Ohlin and Stolper-Samuelson theorems often emphasize changes in the relative price of commodities as a measure of trade liberalization because these theorems argue that trade liberalization affects factors.

Salisu and Ademuyiwa (2013) assess using an augmented gravity model the implications of trade agreements for bilateral trade drawing in WAEMU. They show that economic size, geographical and political factors are the main drivers of bilateral trade in WAEMU. The results reveal that economic size, distance, geographic factors such as common border, landmass, country isolation and socio-economic variables such as common language, political stability and infrastructure availability significantly influence intra-regional trade within ECOWAS. They also note that the region dominated by Francophones (UEMOA) is the source of export while the region dominated by Anglophones (WAMZ) is diverted from trade. Therefore, for ECOWAS to succeed in facilitating intra-regional trade, current efforts to create synergy between UEMOA and ECOWAS should take into account the promotion of trade between members, regardless of colonial origin.

Fadeyi et al. (2014) assesses the impact of the SADC Free Trade Agreement on South African agricultural trade by using the Pseudo-Maximum Likelihood (PPML) specification of the gravity model to determine the meaning of variables in the model. The results show that there has been a net trade creation effect and an increase in beef trade within SADC. Intra-regional trade in maize has also been boosted by the implementation of the agreement. Dennis and Allen (2006) analyze the impact of regional trade agreements and trade facilitation in the Middle East and North Africa region. Using the Global Trade Analysis Project (GTAP) model, they show that intra-regional integration has had a positive impact on well-being in the MENA region. Welfare gains have at least tripled when the implementation of RTAs is complemented by improvements in trade facilitation.

Nin-Pratt et al. (2009) show that the general effects of an FTA on well-being would be positive but limited. Inefficient agricultural producers with a regional comparative advantage for agriculture would benefit from the creation of trade with the rest of the world. These results suggest that the region should look at regional policies and interventions beyond trade agreements, such as those targeting investment, agricultural productivity and diversification, to enhance the benefits of regional trade liberalization. Lewis et al. (2001) study FTA between SADC economies by developing a multiregional CGE model comprising seventeen sectors, fourteen regions, where regional models of CGE are interconnected by trade flows. The author analyzes by simulation the impact on African economies of regional and global tariff reductions and shows that: (i) Trade creation dominates trade diversion for the region under all free trade agreements; (ii) With the exception of Botswana, other SADC countries benefit from an FTA between the EU and South Africa; (iii) Zimbabwe and the rest of the SADC region benefit more from duty-free access to EU markets than from a partial reduction (50%) in world tariffs. (iv) The South African economy is not large enough to serve as a growth pole for the region; (v) Access to EU and/or world markets provides substantially greater gains for other SADC countries than access to South Africa.

In a broader framework, Walters et al. (2016) measure the effects of the COMESA-EAC-SADC Tripartite Free Trade Agreement on the South African economy using a computable general equilibrium (CGE) model. The results of the simulation show that

South Africa's economy is benefiting from the implementation of the trade agreement, with GDP growing by more than 1% compared to the baseline scenario. This increase in overall economic activity is the result of an increase in the terms of trade and a boost in regional trade, which allows for higher levels of exports and imports. Export stimulation increases the activity of local industries, while relatively cheaper imports result in welfare gains for local consumers. The intensification of commercial and industrial activity is leading to an increase in the demand for endowments, including skilled and unskilled labor, capital and land, which is driving up wages and capital rents.

Bergstrand et al. (2011) analyze six FTAs in the European Union and reveal that they had a "significant impact on trade when initial tariffs were high and that these tariffs were rapidly and substantially eliminated for all types of merchandise." They also showed that where "tariffs were already low, few effects were noted." Péridy and Roux (2012) in a study of Euro-Med agreements have shown that the effects are lower in cases where partner countries are slowly reducing their tariffs. They indicate that the elimination of tariffs does not mean a removal of trade protection "and show" that in reality, overall protection remains high."

Malhotra and Stoyanov (2008) studying the Canada-Chile FTA found that the partially and asymmetrically applied agreement had led to a deterioration of Canada's trade balance with Chile. In fact, Canada's total imports from Chile had increased more rapidly than its exports. But it is not possible to compare the two studies to determine whether Canada's negative trade movements have been mitigated (or reversed) after the full implementation of tariff reductions on agricultural products in Chile. Thus, an opportunity has been missed to assess the implications of asymmetric tariff reduction in the literature.

Comparing two studies on the Australia-Thailand FTA provides a second example. Athukorala and Kohpaiboon (2011) find that the agreement has contributed to a significant expansion of trade. But Milton and Siddique (2014) conclude that this has resulted in only modest commercial creation. They explicitly address the difference in the results of the two studies and suggest as a possible explanation that they have aggregated data that "may mask the changes that occur at a disaggregated level" but the literature evaluated does not include any "overview Which allows one to judge the balance of positive and negative effects on all the main issues of an FTA. Péridy and Roux (2012) review the results of previous studies on the Euromed agreements and ask to what extent the experience of a single region should be generalized. This fragmentation of studies is a constraint to comparative analysis. Indeed, there are problems of comparability of evaluation criteria for studies using different methodologies and dealing with different FTAs. Of nine studies evaluating the impact of FTAs, less than half (four) found a positive effect in and five studies found that at least one partner gained nothing.

An analysis of "the substantial liberalization of Jordan over the past two decades" reveals that "the impact has been rather weak" (Busse and Gröning, 2012). One study concluded that the FTA between Australia and Thailand had "had modest effects on trade creation" (Milton and Siddique (2014).

The FTA between the EU and Chile was similarly valued as having triggered "a small overall economic gain" (Jean et al., 2012). An article by Péridy and Roux (2012) on 24 studies of the Euro-Med FTA shows an impact on GDP ranging from + 8.9% to −1.6% and exports of + 54.1–0.9%. The survey shows great differences even between single country studies. For Morocco, for example, the estimated impact on GDP ranges from + 12.2% to −1.6%. Even studies that find significant effects also indicate that the result can vary considerably from one country to another (and also according to the methodology applied). Parra Robles et al. (2012) use fixed effects estimates to assess the effects of six FTAs involving MENA countries and find that: The Euro-Med FTA has had a positive and significant impact on EU exports to countries MENA region, but not vice versa; the FTA between MENA countries had a positive and significant impact on Turkish exports and a positive but not significant effect on MENA exports; FTAs between the United States and Morocco and Jordan had a positive impact on MENA industrial exports, but mainly because of Jordanian exports of textile and clothing products; and the customs union between the EU and Turkey has had a positive and significant impact for both imports and exports. In conclusion, the extent to which an FTA will result in effective policy change depends in part on the relative importance of the tariff barriers it reduces and non-tariff barriers.

3. DATA SOURCES

The data sources are multiple. The data used for the ex-ante analysis of intra-African trade comes from the United Nations Conference on Trade and Development (UNCTAD) for the period 1995-2017 It provides a wide range of relevant statistics and indicators for the analysis of international trade, investment and development.

For the gravity model data: The dataset groups five types of variables: (i) Nominal bilateral trade flows, (ii) aggregate nominal exports at the national level, (iii) relative prices (iv) nominal GDP, and (v) bilateral factors known to impede trade, including geographical distance, common borders, colonial and linguistic ties, having a common currency, relative prices and degree of trade liberalization by partners.

The model is estimated using annual data from 2000 to 2016. The GDP data (GDP_{it}, GDP_{jt}) in current US dollars, converted at current exchange rates, can be found in the International Financial Statistics for International Monetary Fund or in the World Bank's World Development Indicators. The relative bilateral prices P_{it}/P_{jt} of country j relative to country i are obtained from the export and import price data of the Penn Word Table database for each country. For transport costs between two countries, we took as approximation the distance between the capitals of i and j (d_{ij}) and the internal distance calculated by the CEPII. Because of the sensitivity of exports to distance, these transportation costs must be a major concern for the exporter; and the longer the distance, the higher the costs. With regard to the contiguity variable (contig), a dummy variable was introduced equal to 1 if the two trading partners have a common border, if not equal to 0. The common history was captured by the colony equal to 1, if the exporting country had the same a colonizer as its trading partner.

Free trade variables are the index of free trade of the exporting country and the importing country, investment restrictions of the partners, control of capital movements, freedom to visit the exporting country by foreigners. The freedom trade by countries i and j (LC_{it}, LC_{jt}) is a composite measure of the extent of tariff and non-tariff barriers that affect imports and exports of goods and services. The commercial freedom score is based on two variables: The trade-weighted average duty rate and the non-tariff barriers (NTBs). Different imports entering a country can (and often do) face different tariffs. The weighted average tariff uses weights for each tariff based on the share of imports for each product. Weighted average rates are a purely quantitative measure and take into account the calculation of the basic score of freedom of trade using the following equation:

$$LC_{it} = 100(Tariff_{max}\text{-}Tariff_{it}) / (Tariff_{max}\text{-}Tariff_{min})\text{-}BNT_{it})$$

Or

- LC_{it} represents commercial freedom in country i;
- $Tariff_{max}$ and $Tariff_{min}$ represent the upper and lower limits of duty rates (%);
- $Tariff_{it}$ is the weighted average tariff rate (%) in country I;
- $Tariff_{min}$ is the minimum rate that is naturally zero percent, and the upper limit is 50%.

An NTB penalty is then subtracted from the base score.

- The extent of NTBs in a country's trade policy regime is determined using both qualitative and quantitative information. Restrictive rules that hinder trade vary widely, and their overlapping and changing nature makes their complexity difficult to assess.

The Index is built by Heritage Foundation, ranges from 0 to 100 and relies on the following sources to determine trade policy scores, in order of priority: World Bank, World Development Indicators; WTO, Trade Policy Review; Office of the United States Trade Representative, World Bank Trade Barrier Report.

The control of capital markets is also considered taking into account the investment restrictions (RI_{it}, RI_{jt}). Investment restrictions are based on the following two questions from the Global Competitiveness Report: "Foreign ownership of enterprises in your country is rare, limited to minority issues and often prohibited in and the rules governing foreign direct investment harm or discourage foreign direct investment or promote foreign direct investment. The index ranges from 0 to 100. The main source is the World Economic Forum.

The freedom to visit the exporting country from foreigners (LVE_{it} is an important variable in the liberalization of trade. Tourism promotes consumption and consequently exports. The Index is also built by Heritage Foundation and ranges from 0 to 100.

4. INDICATORS OF EX-ANTE ECONOMIC EVALUATION OF FREE TRADE AGREEMENTS

In this section, we will successively present the regional trade interdependence indicators, the concentration or diversification indicator and the introversion trade indicator as well as their strengths and weaknesses.

4.1. Indicators of Regional Trade Interdependence

Before the formation of an FTA, it is important to know to what extent the countries in an FTA are already trading with each other. Trade here refers to the sum of imports and exports. The share of intra-regional trade and the intensity of regional trade are the indicators normally used as measures of existing trade interdependence. For each indicator, a high value may indicate that the countries of the proposed FTA have lower trade costs than others for trade with non-FTA countries. Here, the commercial costs are interpreted broadly to include all the costs incurred to obtain a good for the end user i.e., the marginal cost of production of the good, including transport costs (freight and time), political barriers (tariffs and barriers), information costs, contract execution costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail). If a high value is indeed due to falling commercial costs, then an FTA can be beneficial because it encourages trade between trading partners. Conversely, if a low ratio is due to higher commercial costs, then an FTA may be harmful because it promotes "unnatural" trade.

4.1.1. Subregional commercial sharing

The share of sub-regional trade is defined as the ratio of trade between the countries of the proposed region and the total trade of all these countries. This indicator shows the relative importance of trade in the region in relation to the total trade of all regional members. This indicator is simple to calculate and can be used by a single country or group of countries to measure the regional focus of trade. The table above shows trends in intra-regional trade shares of nine regional groupings and the African continent. Trade data were used for the period 2010-2016 for all members of regional groupings in 2016. Therefore, the composition of each group is determined in the calculations. It is clear that, on average, WAEMU's share of intra-regional trade is smaller than that of SACU, which in turn is smaller than that of SADC, which is lower than that of EAC. This shows that the smaller the share of the group in African and global trade, the lower the intra-regional share tends to be. Nevertheless, if we consider the intra-regional market shares over time, there is a slight upward trend for WAEMU and Africa in general between 2011 and 2016, going from −8% in 2011 to 14%. % in 2016 for the first and −4% to 1% for the second. As shown in the Table 1 below, the trend is almost identical. The main driver of increased intra-regional trade in Africa is the EAC, SADC and SACU. UEMOA comes fourth.

However, there are two important problems in its use, as shown by Anderson and Norheim (1993). First, even if there were no regional bias in trade between members, the share of intra-regional trade would tend to be higher simply because there are more member countries. To see why, consider what happens to intra-regional trade if a region is simply divided into several countries, thus keeping the region's trade with foreigners constant. Intra-regional trade would increase because some old domestic transactions would now become regional export and import flows. As this increase increases the numerator more than the denominator of

intra-regional trade, the indicator would also increase. Secondly, the higher the share of global non-world trade, the more likely it is that regional members will trade with each other and less likely to do so with non-member countries. The share of intra-regional trade would be higher simply because members hold a greater share of world trade regardless of trading partners. When comparing the share of intra-regional trade over time or between groups of countries, it is important to note whether membership in the regional grouping changes and to compare the growth of total trade of a region with trade total of the world.

4.1.2. Intra-regional trade intensity

Intra-regional trade intensity is defined as the share of intra-regional trade divided by the share of total trade in the region in world trade. The numerator, the share of intra-regional trade can be considered as the probability that any regional trade of 1 $ is an intra-regional transaction. The denominator, the total share of the region's trade in world trade, may be considered as the probability that any value of $ 1 of world trade is a transaction involving at least one regional member. The closer the numerator and the denominator are (i.e., the greater the intensity of intra-regional trade is close to 1), the more neutral the regional trade. In other words, the region tends to have no trade bias between its members or with foreigners. If the indicator is >1, then the region has a preference for trade within it; If the indicator is less than 1, the region tends to negotiate with strangers. The intensity of intraregional trade will tend to increase when a region's share of trade increases faster than its share in world trade.

Table 2 gives the indices of trade intensity. The indices are >1. This is reflected in the tendency of the different groups to trade among the members. For Africa in general, UEMOA and other groups in particular, intra-regional trade tends to increase, which explains the rise in trade intensity between 2010 and 2016.

The intra-regional trade intensity index has certain limitations that affect its use and interpretation (Iapadre, 2006). First, the maximum value of the index is a decreasing function of the total trade of the region. As a result, the indices calculated for different regions and/or periods are not perfectly comparable with each other due to their different ranges. Second, the index may be inconsistent with its complementary indicator - the extra-regional trade intensity index. The extra-regional trade intensity index measures the intensity of trade between the countries of the region and those outside. Mathematically, intraregional and extra-regional trade intensity indices may move in the same direction over time. This creates a problem of interpretation because regional trade can not be simultaneously biased towards countries in the region and those outside.

Table 1: Evolution of the infra-regional trade share

Région	2010	2011	2012	2013	2014	2015	2016
UMA	2.39	2.68	2.65	3.55	4,11	4.11	4.14
CEMAC	3.35	3.59	2.43	2,79	2.81	2.90	3.14
CEN-SAD	6.23	6.42	6.23	7.31	7.00	8.06	9,18
COMESA	7.16	8.91	7.42	8.82	9.54	11.38	10.24
CAE	18.63	19.56	21.01	19.55	22.35	23.25	20.31
CEEAC	2.04	2.18	1.35	1.69	1.58	1.73	1.82
CEDEAO	7.45	7.11	7.41	8.96	7.80	8.96	10.61
SACU	14.76	12.53	13.84	14.23	15.20	17.07	15.17
SADC	18.04	16.40	18.18	18.66	19.32	21.81	20.57
UEMOA	12.54	11.49	13,17	12.62	14.90	12.63	14.39
Afrique	13.81	13.24	13.37	14.46	15.31	17.59	17.75

Source: CNUCED, 2017

4.2. Export Diversification Index

Export diversification is considered important for developing countries because many developing countries often rely heavily on relatively few primary products for their export earnings. Unstable prices for these products can expose an exporter from a developing country to serious terms of trade shocks. Given that the covariation of prices of individual commodities is far from perfect, diversification to new primary export products is generally considered a positive development. The strongest positive effects are generally related to the diversification of manufactured goods, including higher and more stable export earnings, job creation and learning effects and the development of new skills and infrastructure that will facilitate development of new export products.

Export diversification is measured using a standardized Herfindahl-Hirschman index, without providing a clear threshold for distinguishing between diversified and concentrated exports. We draw inspiration from the "Federal Merger Guidelines" produced by the Federal Trade Commission and the US Department of Justice to facilitate the interpretation of the Herfindahl-Hirschman Index and distinguish between diversified or moderately concentrated exports or markets. and those highly concentrated Figure 1. This document uses the following three categories and thresholds:

- Exports or diversified markets (non-concentrated): IHH <0.15;
- Exports or markets moderately concentrated: 0.15 ≤ IHH <0.25;
- Exports or highly concentrated markets: IHH ≥0.25.

Table 2: Intra-regional commercial intensity from 2010 to 2016

Région	2010	2011	2012	2013	2014	2015	2016
UMA	2.576	3.648	2.819	4.481	6.304	8.214	8.988
CEMAC	14.357	14.754	10.091	12.629	13.422	20.594	27.409
CEN-SAD	3.859	4.379	3.797	4.997	5.443	7.856	9.608
COMESA	9.244	16.550	10.208	13.798	18.971	26.293	23.419
CAE	253.711	270.989	263.382	272.095	305.913	276.161	229.907
CEEAC	3.393	3.356	2.036	2.733	2.810	4.532	5.617
CEDEAO	9.930	8.405	8.802	11.686	10.715	16.870	23.531
SACU	21.983	18.806	22.683	24.204	26.662	29.848	27.263
SADC	15.254	13.486	15.373	16.428	17.966	22.761	22.527
UEMOA	92.731	87.683	102.419	97.069	106.856	89.676	101.474
Afrique	4.053	3.976	3.866	4.553	5.273	7.457	8.074

Source: CNUCED, 2017

Chart 1 shows the diversification indices of the African continent and the various economic groupings over the period 1995-2016. From 1995 to 2016, the Herfindahl-Hirschman index for export products of the various economic groupings was consistently higher than 0.25 reflecting highly concentrated exports from the different economic zones and the continent. The UEMOA diversification index stood at 0.725 and that of Africa at 0.578 reflecting the high concentration of exports.

4.3. Export Concentration Index

The United Nations Conference on Trade and Development (UNCTAD) publishes a concentration ratio based on the standardized Herfindahl-Hirschman index for a set of countries, including Africa and the different economic zones. The data aggregation is based on the Standard International Trade Classification (SITC Revision 3 at the 3-digit level) and covers a total of 261 products.

The graph below gives the concentration index for the different groups and for Africa. According to the Herfindahl-Hirschman index used as an inverse measure of product diversification, economic groupings showed varying levels of product concentration during the period from 1995 to 2016. WAEMU is 0.27 below the Africa level (0.34) reflects the low diversification of exports.

Over the last 20 years, Africa's various economic clusters have relied on export earnings as a contributor to their GDP. Product concentration levels are high as shown in Figure 2 below. This has led to fluctuations in product prices due to unexpected changes in world (commodities) activity that affect the export earnings of the different zones leading to significant terms of trade disruptions.

At present, regional economic agreements "are characterized by limited trade, dependent on primary products and limited trade between African countries. The majority of a country's exports to the rest of the continent is often limited to a few products. as shown in the table below: Over the 2011-2016 period, exports of the five main products of African countries declined, with Africa and WAEMU, 9% and -2.4% for agricultural products, −6.4% and −29.1% for fertilizers, −3.8% and −42.7% for forest products, −11% and −55.6% for fossil fuels and −3.9% and −5.7% for metals and minerals.

4.4. Regional Index of Commercial Introversion

Given the problems of the two previous regional indicators of trade interdependence, Iapadre (2006) proposed the regional trade introversion index to measure the relative intensity of regional trade. The formula for the extra-regional trade intensity index is equivalent to (1 - Share of intra-regional trade)/(1 - Share of world trade of the region).

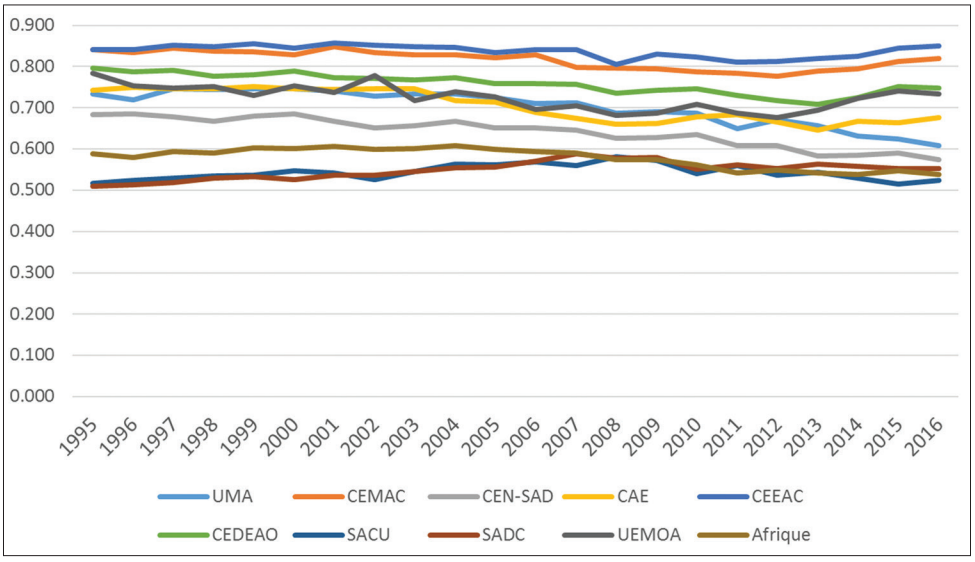
With this index, the intensity of intraregional trade and the intensity of extra-regional trade are functions of the region in intra-regional trade and of the region in world trade. The index is independent of the size of the region. The index increases (or decreases) only if the intensity of intra-regional trade increases more (or less) rapidly than that of extra-regional trade. If the index is zero, the region's trade is geographically neutral. If it is greater than zero, trade in the region has an intra-regional bias; if it is less than zero, trade in the region has an extra-regional bias.

Table 3 above represents the regional indices of commercial introversion for economic groupings in Africa from 2010 to 2016. The indices for all ten regions are >0 for most of the period, indicating intra-regional bias in trade. In 2015 and 2016, the index for Africa fell to 0.844 and 0.841, respectively. For WAEMU, in 2012, 2014 and 2016, the index fell because the WAEMU trade fell back. As the table shows, the 10 regions have increasing trends in intra-regional trade.

4.5. Strengths and Limitations of Commercial Indicators

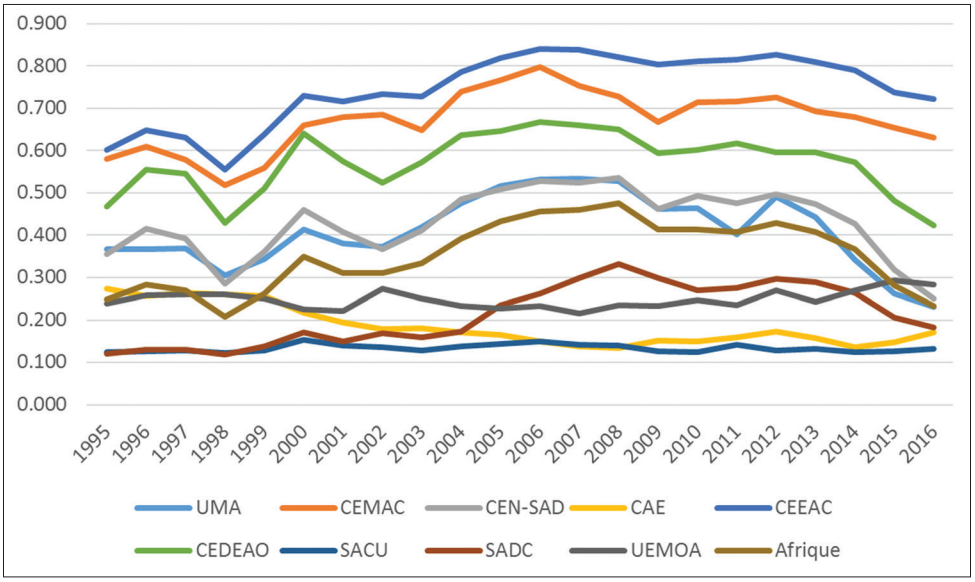
The main advantages of using trade indicators are that they are relatively easy to understand, that their data needs are easily met and that their calculation is simple. However, their main limitation is that since these indicators are a-theoretical and the interpretation

Figure 1: Export diversification index 1995-2016



Source: CNUCED, 2017

Figure 2: Export concentration index 1995-2017



Source: CNUCED, 2017

Table 3: Regional index of commercial introversion

Région	2010	2011	2012	2013	2014	2015	2016
UMA	0.985	0.980	0.983	0.972	0.965	0.964	0.963
CEMAC	0.969	0.966	0.978	0.974	0.974	0.972	0.970
CEN-SAD	0.953	0.950	0.953	0.941	0.942	0.929	0.917
COMESA	0.936	0.916	0.933	0.918	0.909	0.890	0.902
CAE	0.814	0.805	0.791	0.805	0.777	0.768	0.798
CEEAC	0.986	0.985	0.993	0.989	0.990	0.986	0.985
CEDEAO	0.932	0.937	0.934	0.917	0.929	0.915	0.898
SACU	0.858	0.881	0.867	0.863	0.853	0.834	0.853
SADC	0.829	0.846	0.828	0.823	0.816	0.789	0.802
UEMOA	0.876	0.886	0.869	0.875	0.852	0.875	0.857
Afrique	0.892	0.897	0.897	0.883	0.872	0.844	0.841

Source: CNUCED, 2017

of the results can be difficult. In addition, for the indicators presented in the section on trade indicators, the results may not be meaningful if the indicators are calculated for categories of trade that are too aggregated or classified.

5. ECONOMETRIC FRAMEWORK

In this section we will present Heckman's (1979) model and then the structural gravity model, and then deduce from it the empirical model before proceeding with its estimation and the presentation of the results.

5.1. The Heckman Model

To the extent that one of our objectives is to evaluate the impact of free trade and, more specifically, to signal the impact of free trade, we must take into account not only real bilateral trade but also zero. The null values found in the commercial database actually correspond to either a truly zero rate or a rate below a certain reporting threshold. These last are very low and thus assimilated to an absence of trade. The log of bilateral exports is a truncated variable. There is a selection bias. In order to correct this bias, Heckman constructed a two-step estimation in which he assumes that there is an underlying regression relationship. He defines two equations:

$$logX_{ijt}=\beta V_{ijt}+\varepsilon_{ijt} \quad (1)$$

The dependent variable X_{ijt} (bilateral exports from country i to country j to time t) is observed for the triplet (i = exporting country, j = importing country, t = year) if:

$$\alpha Z_{ijt}+\vartheta_{ijt}>0 \text{ Ou}$$
$$\begin{cases}\varepsilon_{ijt}\rightarrow N(0,\sigma)\\ \vartheta_{ijt}\rightarrow N(0,1)\end{cases} \quad (2)$$

$$\text{Et } \rho=corr(\varepsilon_{ijt},\vartheta_{ijt}) \quad (3)$$

Or $\rho\neq 0$ the two equations are not independent and the standard regression techniques applied to $logX_{ijt}$ would produce biased results. Heckman proceeds in two stages. First, he estimates the following probit equation:

$$X_{ijt}=1 \text{ si } \alpha Z_{ijt}+\vartheta_{ijt}>0 \quad (4)$$

$$X_{ijt}=0 \text{ otherwise}$$

Where: $X_{ijt} = 1$ if country i exports to market i and otherwise $X_{it}=0$. Z is a vector of independent variables determining the probability that country i exports to country j. This step leads to the estimation of for each observation of the selected sample; it is possible to calculate the Mills ratio:

$$M = \frac{\varphi(\hat{\alpha}Z)}{\phi(\hat{\alpha}Z)} \quad si \quad X_{ijt} = 1 \tag{5}$$

Where $\varphi(\alpha Z)$ and $\varphi(\alpha Z)$ are respectively the probability density of the normal law and the cumulated probability function. In the second stage, that is, the regression on exports. The Mills report is introduced with the other explanatory variables. This second stage consists, in Heckman's seminal study (1979), in an ordinary least squares regression. But while this leads to consistent estimates, they are ineffective and there is heteroskedasticity in error variances. In this paper, instead of the MCO estimates, the Huber-White variance estimator is used instead of the conventional MLE estimate to obtain robust estimates of variances. The explanatory variables of our regression estimation are those presented in the equation.

5.2. The Structural Model of Gravity

The gravity model consistent with the theory of Anderson and Van Wincoop (2003) can be written by omitting sectoral exponents k to focus on the case of global trade. The theoretical development above leads to the estimable gravity equation:

$$logX_{ij}=logY_i+logY_j-logY^k+(1-\sigma_k)[log\tau_{ij}-log\pi_i-logP_j] \tag{6}$$

$$\pi_i = \sum_{j=1}^{C} \left\{ \frac{\tau_{ij}}{P_j} \right\}^{1-\sigma} \frac{Y_j}{Y}$$

$$P_i = \sum_{j=1}^{C} \left\{ \frac{\tau_{ij}}{\pi_i^k} \right\}^{1-\sigma} \frac{Y_j}{Y}$$

As noted above, this model has important implications for the estimation technique adopted because it includes freedom of trade variables that are omitted from the intuitive model. Moreover, these variables are not observable because they do not correspond to any index collected by national statistical agencies. We therefore need an estimation approach that allows us to take into account the effects of trade regulation in the countries of origin and destination of exports, even though these factors can not be directly included in the model. The variables of freedom of commerce are: Freedom of commerce for countries i and j (LC_{it}, (LC_{jt}); the international control of the capital markets is also considered taking into account the investment restrictions (RI_{it}, RI_{jt}). The expression of the tariff equation is then:

$$log\tau_{ij}=b_1\ logdistance_{ij}+b_2\ contig+b_3\ comlang_{off}+b_6\ comcol+b_7\ LC_{it}+b_8\ LC_{jt}+b_9\ RI_{it}+b_{10}\ RI_{jt}+b_{11}\ CC_{jt}+2CC_{jt} \tag{7}$$

In addition, the size of the economy represented by GDP (GDP_{it}, GDP_{jt})determines the level of bilateral exports. The bilateral export equation can be rewritten as:

$$\begin{aligned} \log X_{ijt} = {} & \log Y_{it} + \log Y_{jt} - \log Y^k + a_1 \log PIB_{it} + \\ & a_2 \log PIB_{jt} + a_3 \log \frac{P_{it}}{P_{jt}} + a_4 LVE_{jt}(1-\sigma_k) \\ & (b_1 \log dis\tan ce_{ij} + b_2 contig + b_3 comlang_{off} + \\ & b_6 comcol + b_7 LC_{it} + b_8 LC_{jt} + \\ & b_9 RI_{it} + b_{10} RI_{jt} + b_{11} CC_{jt} + b_{12} CC_{jt}) \end{aligned} \tag{8}$$

For probit, we explain the fact that countries export or do not export to a specific market. The probability of exporting depends on the geographical distance, the common border, the colonial and linguistic link, the fact of having a common currency of the relative price of exports and the consumption of the importing country. These explanatory variables have been introduced into the probit and allow to have the following equation:

$$\begin{aligned} Probit\left(X_{ijt}=1\right) = {} & \theta_1 \log dis\tan ce_{ij} + \theta_2 contig + \\ & \theta_3 comlang_{off} + \theta_4 comcol + \\ & \theta_5 comcur + \theta_6 \log \frac{P_{it}}{P_{jt}} + \theta_7 \log Cons \end{aligned} \tag{9}$$

The estimated model is ultimately an equation system consisting of the probability of trading and exports.

6. ESTIMATION AND INTERPRETATION OF THE RESULTS

6.1. The Model of Intra-African Trade

The convergence is fast since it takes place after only 4 iterations (Appendix 1). With a Wald statistic of 58.89, the estimated model seems well specified: The hypothesis H0 that all the coefficients are equal to zero is easily rejected. We find that the total sample is made up of 11162 country pairs. The estimation of the selection equation is done using all the observations, whether or not the countries have exported. For the second step, we use the uncensored observations, that is to say only the observations of the countries that have chosen to trade.

Let's linger a few moments on the other estimates. Let us first note the lambda estimate which corresponds to the inverse of the Mill's ratio. As for rho, it is of course the coefficient of correlation of the error terms of the two equations of the model.

The model is estimated by the likelihood maxima method, a Chi-square test is performed to check if ρ is significantly different from 0 (H0: ρ = 0). The rejection of the null hypothesis (Prob> chi2 = 0.00 if critical threshold at 5%) means that the substantial equation is not independent of the selection equation; the two decisions are not made independently of each other. This is why we can say that an estimation of the model by the OLS would have provided biased estimators. The model explaining exports corresponds to this situation since the $P=0$.

Regarding the significance of the coefficients, we find that for the selection model, the relative price and the common national

language variables have negative effects on the probability of export but are not significant at 5%. As for the export equation, all variables are significant at 5%.

The signs of the estimated coefficients are similar to those expected for most variables. According to the results obtained, the more the distance between two countries increases, the more the probability of exchange decreases. Similarly, the existence of a common border and historical link through the same colonizer between two countries increases the probability of export. The existence of a common currency increases the probability of exchange. Regarding the quantity consumed by the importing country, we find that the variable estimator displays a positive and significant sign. The probability of exporting increases as consumption in the importing country increases.

For intra-African exports, the estimated coefficients of Africa's exports to Africa are interpreted as follows: The size of the importing country and the exporter has a positive and significant impact with respective elasticities of 0.668 and 1.099 so that a 10% GDP increase in the destination country increases exports by 6.68% and 10.99% respectively.

An increase in the relative price of exports leads to a drop of 10% leading to a 31.64% drop in exports. Rising relative prices lead to a deterioration in the terms of trade of the exporting country, which reduces incentives to export.

An increase in the distance between the exporting country and the importing country of 10% reduces exports by about 14.96% due to increased transport costs. The existence of cross-border links, historical links through colonization, the existence of a national language and a common currency implies an increase of exports from Africa to Africa respectively of 132.33% (exp. (0.843) −1), 58.56%, 51.43% and 46.52%.

The existence of a Regional Trade Agreement creates trade between members by increasing exports by 291% (exp (1.364) −1).

The variables of freedom of international trade have all the expected signs. The coefficients of the trade liberalization variables are semi-elasticities. An increase in the free-trade index of the exporting country and the importer of 10 leads respectively to an increase in exports of 2.49% and 0.49%, ie a total increase of 2.98% in intra-EU exports. African.

Rates are the oldest form of protection. They are taxed on the import and export of products. When tariffs on imports of products are low, they encourage imports and lower prices to domestic consumers. When those imposed on the export of commodities are low, they encourage exports and make goods available to foreign consumers.

Therefore, freedom of trade is a central factor for African countries and in particular those of UEMOA. It creates greater sales potential for businesses. In addition, freedom of trade helps boost competitiveness because of the presence of foreign goods and services for use in production.

A 10-point increase in the capital control score of the country of origin and destination of exports results in respective decreases in exports of 0.59% and 1.04%, for a total increase of 1.63% of exports intra-African.

International control of capital markets is measured by investment restrictions. It has a negative and significant effect on exports.

Investment restrictions are based on two pillars: The first is that foreign ownership of companies is limited and often prohibited in key sectors; and the rules governing foreign direct investment are very unattractive. A free and open investment environment offers maximum entrepreneurial opportunities and incentives for expanded economic activity.

Restrictions on both domestic and international investment by African countries undermine the efficient allocation of resources and reduce productivity, which distorts economic decision-making. Restrictions on cross-border investment can limit both inflows and outflows, reducing markets and growth and export opportunities. In an environment where individuals and businesses are free to choose where and how to invest, capital can achieve its best uses in the sectors and activities where it is most needed and where returns are greatest. The measures taken by African states to redirect the flow of capital and limit choices impose a freedom on both the investor and the person seeking the capital. The more a country imposes investment restrictions, the lower its level of entrepreneurial activity and the lower its exports.

The control of capital movements through the exchange rate leads to a drop in exports of 1.11% if the initiative comes from the authorities of the exporting country to increase its score by 10. On the other hand, it leads to an increase in exports if it is implemented by the importer of 0.90%. Overall, the effect is negative and stands at −0.021% (−1.11% + 0.90%).

Exchange control involves government regulation of the purchase and sale of foreign currency. Under the exchange control system, all exporters are required to return their claims to the central bank of the country in exchange for the national currency at the rate set by the government. The government then allocates the currency between the licensed importers. Thus, restrictions on capital movements through the exchange rate contribute to the decline in exports.

Exchange control is often used to correct an adverse balance of payments or to protect the domestic industry or to preserve foreign resources or to maintain the exchange rate at a predetermined parity.

The freedom of foreigners to visit has a positive impact on exports. A 10-point increase in the index increases exports by 1.63%. Freedom of visit favors tourism favors consumption in the host country and consequently exports.

6.2. The WAEMU-Africa Trade Model

For this model, convergence is obtained after only 6 iterations (Appendix 2). With a Wald statistic of 9.30, the estimated model seems well specified: The hypothesis H0 that all the coefficients

are equal to zero is easily rejected. We also find that the total sample is made up of 1922 pairs of countries. The estimation of the selection equation is also done as in the first model using all the observations, whether or not the countries have exported. For the second step, we also use the uncensored observations, that is to say only the observations of the countries that have chosen to trade.

The chi-square test performed to check if ρ is significantly different from 0 (H0: ρ = 0). The rejection of the null hypothesis (Prob> Chi-square = 0.00, if critical threshold at 5%) means that the substantial equation is not independent of the selection equation; the two decisions are not made independently of each other. We conclude for this model that an estimation of the model by the OLS would have provided biased estimators. The model explaining exports corresponds to this situation since the P = 0.

The results for the "classic" variables are consistent with the expectations of a gravity model and are significant at 5% except for the selection model where the contiguity and common national language variables are not significant.

For the selection model, the export probability is restricted when the distance increases. Similarly, when the relative price of exports increases, the probability of exporting decreases as in the case of the intra-African model of trade. On the other hand, having the same colonizer, the same currency, increases the probability of exporting. The growth of consumption of the importing country also increases the exchange rate of exports.

With regard to the export equation, the size of the economy measured by GDP has a positive effect on exports. Indeed, an increase in the GDP of the importing country and the exporter of 10% leads respectively to an increase of exports of 5.72% and 18.24%. The latter is higher than the coefficient of the intra-African trade model.

Distance restricts trade between two countries. An increase in the distance between two partner countries of 1% leads to a decline in exports of WAEMU countries of 1.407%.

The deterioration of the terms of trade price following a rise in the relative price leads to an increase in exports. Since WAEMU countries' exports to Africa are essentially commodities, the deterioration in the terms of exchange price leads to an adjustment by volumes to maintain the value of exports. This has the effect of generating impoverishing growth, which is manifested by an increase in export volumes following a fall in the prices of exported products.

Conversely, having a common border, a common history (colony), a national language and a common currency stimulates trade between partners (UEMOA, Africa) respectively by 20.8% (exp (0.189) −1), 127.27%, 103.8% and 88.32%.

For the trade liberalization variables, the signs are in line with our expectations except the control of capital movements through the exchange rate of the importing countries.

The increase in the free-trade index of the exporting country and the destination country of 10 points leads to an increase of exports respectively of 16.35% and 3.06%, i.e. a total of 19.41% if the measure is taken simultaneously by the two partner countries. This measure would on average benefit the WAEMU countries more than the others in the African countries.

On the other hand, restrictions on investment and control of capital movements through control have negative effects on exports. A 10-point increase in the investment restriction index of the exporting country and the country of destination decreases exports by 11.69% and 1.46% respectively. The average effect on WAEMU-Africa trade is higher than that on intra-African trade. In total, the impact is 13.35% (11.69% + 1.46%) on exports.

The control of capital movements (increase of the index of 10 points) through the control of the exchange rate of the exporting country decreases the exports of 7.65% while the control of the capital movements by the country of destination of the exports increases exports by 1.60%. The residual impact is a 6.05% drop in exports.

The freedom of foreigners to visit has a positive impact on exports. The rise in the 10-point index increases exports by 1.29%.

7. CONCLUSION

The objective of this article was to measure the impact of trade liberalization on intra-African trade in general and in particular on trade between WAEMU countries and Africa. The use of ex-ante evaluation indicators has made it possible to highlight the tendency for African and UEMOA countries to trade with each other. The analysis of these indicators has also highlighted the low diversification and high concentration of exports on commodities but also the introversion of trade of African countries and those of UEMOA. To quantify the impact of trade liberalization on African countries and UEMOA, the gravity model of Anderson and Van Wincoop (2003) is used as a tool for trade analysis because the data is widely available.

The estimation of the model allowed us to show that when export tariffs for commodities are low, they encourage exports and make goods available to foreign consumers. Restrictions on cross-border investment can limit both inflows and outflows, reducing markets and growth and export opportunities. A restriction of capital movements through the exchange rate contributes to the decline in exports. The free movement of populations leads to an increase in exports.

African countries must resolutely commit to lifting tariff and non-tariff barriers in order to fully liberalize trade. They must also remove the obstacles to investment by African partners. In addition, a relaxation of exchange controls and the free movement of populations could boost exports.

The model has high explanatory power and its main strengths in evaluating an FTA are that it allows the analyst to control other trade-related variables and to quantify any changes in a country's trade. Because of the FTA. These quantitative estimates can then be used in well-being calculations. However, the model may

give misleading results if the data is inaccurate or if important variables are omitted from the estimate. In addition, although the gravity model estimation method presented above takes into account most of the basic data and specification problems that arise in implementation, other more complex problems exist. The analyst should refer to recent literature for potential solutions to these problems.

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APPENDIX

Appendix 1: Intra-African trade model

Variables	Coef	Standard error	Z	Prob>|Z|	[95% Conf. Interval]	
logPIB_d	0.668	0.020	34.110	0.000	0.630	0.706
logPIB_o	1.099	0.019	57.000	0.000	1.061	1.136
Prix_relatif	−3.164	0.325	−9.740	0.000	−3.801	−2.527
Logdistw	−1.496	0.050	−29.690	0.000	−1.595	−1.397
Contig	0.843	0.090	9.390	0.000	0.667	1.019
Comcol	0.461	0.062	7.380	0.000	0.338	0.583
comlang_ethno	0.415	0.056	7.400	0.000	0.305	0.525
Comcur	0.382	0.102	3.760	0.000	0.183	0.582
ARC	1.364	0.064	21.460	0.000	1.240	1.489
LC_it	0.249	0.017	14.310	0.000	0.215	0.283
LC_jt	0.049	0.017	2.950	0.003	0.017	0.082
RI_it	−0.059	0.020	−2.930	0.003	−0.098	−0.019
RI_jt	−0.104	0.013	−7.790	0.000	−0.130	−0.078
CMC_it	−0.111	0.044	−2.550	0.011	−0.196	−0.026
CMC_jt	0.090	0.019	4.690	0.000	0.052	0.127
LVEit	0.163	0.019	8.510	0.000	0.125	0.200
Const	−22.147	0.696	−31.810	0.000	−23.511	−20.782
Selection	**Coef**	**Std.err**	**Z**	**Prob>|Z|**	**[95% Conf. Interval]**	
Logdistw	−0.323	0.035	−9.220	0.000	−0.392	−0.255
Prix_relatif	−0.425	0.259	−1.640	0.101	−0.933	0.083
Contig	0.407	0.173	2.350	0.019	0.068	0.747
Comcol	0.223	0.051	4.380	0.000	0.123	0.323
comlang_ethno	−0.075	0.044	−1.700	0.090	−0.162	0.012
Comcur	0.214	0.096	2.220	0.027	0.025	0.403
logccon_jt	0.236	0.016	15.080	0.000	0.205	0.267
Const	2.178	0.387	5.620	0.000	1.419	2.937
/athrho	−0.815	0.106	−7.670	0.000	−1.023	−0.607
/lnsigma	0.890	0.011	81.570	0.000	0.868	0.911
Rho	−0.672	0.058			−0.771	−0.542
Sigma	2.434	0.027			2.383	2.487
Lambda	−1.637	0.155			−1.941	−1.333

Wald test of indep. eqns. (rho=0): Chi-square (1) = 58.89 Prob>Chi-square=0.0000

Appendix 1: Intra-African trade model

Number of obs	11.162
Selected	10.541
Nonselected	621
Wald Chi-square (16)	10055.36
Prob>Chi-square	0.0000
Log pseudolikelihood	−26066.33

Source: Author's calculation

Appendix 2: WAEMU-Africa trade model

Variables	Coef	Standard error	Z	Prob>|Z|	[95% Conf. Interval]	
logPIB_d	0.572	0.047	12.170	0.000	0.480	0.664
logPIB_o	1.824	0.102	17.960	0.000	1.625	2.023
Prix_relatif	6.190	1.342	4.610	0.000	3.560	8.820
logdistw	−1.407	0.118	−11.910	0.000	−1.639	−1.175
Contig	0.189	0.193	0.980	0.328	−0.189	0.567
Comcol	0.821	0.173	4.740	0.000	0.481	1.161
comlang_ethno	0.712	0.127	5.630	0.000	0.464	0.960
Comcur	0.633	0.193	3.280	0.001	0.255	1.012
ACR	1.565	0.183	8.570	0.000	1.207	1.923
LC_it	1.635	0.250	6.540	0.000	1.145	2.126
LC_jt	0.306	0.096	3.200	0.001	0. 0.118	0.493
RI_it	−1.169	0.418	−2.800	0.005	−1.988	−0.351
RI_jt	−0.146	0.030	−4.820	0.000	−0.206	−0.087
CMC_it	−0.765	0.097	−7.920	0.000	−0.955	−0.576
CMC_jt	0.160	0.056	2.850	0.004	0.050	0.271
LVE_it	0.129	0.052	2.480	0.013	0.027	0.230
Cons	−54.04	3.238	−16.69	0	−60.39	−47.693
Selection	**Coef**	**Std.err**	**Z**	**Prob>|Z|**	**[95% Conf. Interval]**	
logdistw	−0.279	0.099	−2.82	0.005	−0.472	−0.0851
Prix_relatif	−3.135	1.339	−2.34	0.019	−5.759	−0.5104
Contig	0.147	0.379	0.39	0.698	−0.596	0.8899
Comcol	0.4803	0.212	2.26	0.024	0.0639	0.8967
comlang_ethno	0.1281	0.15	0.85	0.394	−0.166	0.4223
Comcur	0.6295	0.258	2.44	0.015	0.1245	1.1344
logccon_d	0.2881	0.048	6	0	0.194	0.3821
Const	3.6099	1.345	2.68	0.007	0.9733	6.2464
/athrho	−0.625	0.205	−3.05	0.002	−1.027	−0.2232
/lnsigma	0.812	0.023	35.13	0	0.7667	0.8573
Rho	−0.555	0.142			−0.773	−0.2196
Sigma	2.2524	0.052			2.1527	2.3568
Lambda	−1.249	0.338			−1.912	−0.5864

Wald test of indep. eqns. (rho = 0): Chi-square (1) = 9.30 Prob > Chi-square = 0.0023

Appendix 2: WAEMU-Africa trade model

Number of obs	1922
Selected	1835
Nonselected	87
Wald Chi-square (16)	2543.89
Prob >Chi-square	0.0000
Log pseudolikelihood	−4350.322

Source: Author's calculation